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SUBMUCOUS RESECTION
OF THE
NASAL SEPTUM
BY
WILLIAM MEDDAUGH DUNNING, M.D.

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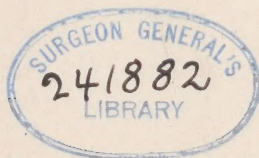
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THE SUBMUCOUS RESECTION OF THE NASAL SEPTUM

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DEDICATED TO
My Students and Teachers

P R E F A C E

This book is a description of the procedure followed in a specialized form of nose surgery, the submucous resection of the nasal septum. Starting in the early years of the century with the operations worked out by Ballenger and Freer which supersede still earlier crushing operations, modifications in procedure have been introduced by the author and others working in this field. The pages which follow show that the changes have affected the technic of posture of surgeon and patient; the manner and method of anesthetization; and the use of specially designed instruments, to which the writer has contributed the Dunning curette elevator.

The first five chapters of the book appeared first as a series of articles in the January, February and March, 1921, numbers of the *American Journal of Surgery*. They have been expanded, revised, and put in permanent form with the addition of three chapters dealing with case records, to meet requests from colleagues and students.

My special thanks are offered to Drs. Harmon Smith, Duncan Macpherson, and Wendell C. Phillips, for many helpful suggestions during the years in which the technic of the operation now used by the writer was in process of development. Dr. Iva L. Peters has also given valuable assistance in the criticism of the neurological material and in the preparation of the manuscript.

W. MEDDAUGH DUNNING.

New York City.

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Fig. 1—Specimen showing outer wall of internal nose, illustrating turbinated bodies and meatuses; *a*, superior turbinate; *b*, superior meatus; *c*, middle turbinate; *d*, middle meatus; *e*, vestibule; *f*, inferior turbinate; *g*, inferior meatus; *h*, superior maxilla; *i*, sphenoidal sinus; *j*, orifice of Eustachian tube.

CHAPTER I

THE NOSE

It is a matter of lively interest to humanity that the nose do its work well. This interest is so great that it is strange to find that attention to the pathology of the nose is to a great extent a matter of our own generation. In our older medical texts consideration of diseases of the nose covers not more than two or three pages. When many present-day practitioners were undergraduate students perhaps one-half of a lecture was devoted to the same subject. But with the accumulation of special knowledge of the past decades growing out of the increase in clinical instruction, a special technic and a rapidly increasing literature has come into existence.

With the development of knowledge concerning the nose and its work came a realization that its prominence exposed it to injuries which became the source of other difficulties often not traced to their true source. Breaks, dislocations, and bruises, often looked upon, at the time, as negligible and of little moment, are later found to have caused blockages of the air passages which have interfered with normal breathing and with the drainage of the sinuses, and have caused serious nervous difficulties. Among the chief causes of these difficulties are deflection of the nasal septum. The development of surgical technic has made possible the correction of many of these difficulties with the aid of the knife.

It is the purpose of this study to put into a permanent form the result of many years of study of the causes and results of deviations of the nasal septum, together with a description of the operation for relief from these deviations—the submucous resection of the nasal septum. Operations for these difficulties have been performed not more than twenty years. The operation is still classed as one of the most delicate and difficult of intranasal operations (Phillips,¹ Porter,² Harmon Smith³). It therefore seems desirable to add to the information available the results of the writer's clinic and private practice in dealing with several thousand cases.

In order to present more clearly the special study, we shall first consider briefly the normal nose, taking into account the pertinent features of its anatomy, physiology, and neurology.

The nose consists anatomically of two parts: the outer nose; and the nasal cavities contained in the skull. The lower segment is the part concerned in respiration. In the upper part the cavities support the membrane containing the nerves of smell. Posteriorly the nose is continuous with the cavity called the nasopharynx, the two openings into which are called the choanæ. The bony frame of the nose is a part of the skull, but the outer nose is supported by bone above only; the rest of its shape is kept by cartilaginous structures varying with race and individual. The anterior part of the nose is known as the ala or vestibule. This combination of bone and cartilage in the struc-

¹ Phillips, Wendell C.: *Diseases of the Ear, Nose and Throat*. Philadelphia, 1919, 5th Ed., p. 536.

² Porter, W. G.: *Diseases of the Throat, Nose and Ear*. 3rd Ed., revised under the editorship of A. Logan Turner, 1919, p. 122f.

³ Wright, Jonathan, and Smith, Harmon: *A Textbook of the Diseases of the Nose and Throat*. Philadelphia and New York, 1914.

ture of the nose is of great importance, as we shall see in the study of fractures, dislocations, and deviations.

The roof of the nose, which is very narrow, is formed on the external side by the ethmoid and behind by the sphenoid. It is here, through the cribriform plate of the ethmoid bone, that some twenty non-medullated nerves pass to supply the sensory organs in the olfactory mucous membrane. This area comprising the olfactory sense is very small, about five square centimeters in area, according to Watson, and consists of a small membrane lining the roof and sides of each nasal cavity.

The external wall of the nose is the most important of its areas from the surgical point of view. Continued malformations of the septum react on this outer wall with grave results. This area is formed by the lateral mass of the ethmoid, the inner surface of the superior maxilla, the vertical plate of the sphenoid. To these outer walls are attached the turbinated bodies, structures made up of thin osseous shell and covered by a vascular cavernous tissue possessing erectile tissue. These turbinated bodies project downward in such a way that the internal nose is divided into three cavities, or meatuses. There are usually said to be three of these bodies in the human nose, although by its lack of function and its difference in structure the body called the superior turbinate, situated quite above and behind and nearly always invisible, is perhaps questionably classed as a turbinate.¹ (See Fig. 1, also compare the drawing of the structure of a deer's nose, Fig. 2.)

The region between the so-called superior turbinate and the roof of the nose is known as the "recessus

¹ Douglas, Beaman: *Nasal Sinus Surgery*. Philadelphia, 1906, p. 18.

spheno-ethmoidalis." Into the back of this recess the sphenoidal air sinus opens. Between the superior turbinate and the middle turbinate is the cavity containing the openings of the posterior ethmoidal air cells. The middle meatus, between the middle and inferior turbinates, is the largest of the three, and contains certain important processes. Here are the opening of the frontal sinus, that of the maxillary antrum, and of most of the anterior ethmoidal cells. Towards the front of this cavity is a ridge, the processus uncinatus; further back is a rounded elevation called the bulla ethmoidalis. Sometimes the bulla is so enlarged that there is the appearance of two turbinated bodies in this region, the outer being the bulla, and the inner the true middle turbinate. The bulla is probably a bone cell belonging to the ethmoidal system.

The inferior meatus lies below the inferior turbinate and extends to the nasal orifice. Its external wall contains the nasal duct, an opening through which a probe can pass to the lachrymal duct. This valvular opening lies on the highest point of the external wall of the inferior meatus. The Eustachian tube leading to the ear lies just behind the posterior border of the inferior meatus, and is almost on a level with the posterior end of the inferior turbinate body.

The nasal septum is the partition between the two nasal cavities, whose features we have just described. It is composed of a triangular cartilage, the "septal cartilage," with a supporting framework made up of the perpendicular plate of the ethmoid above and of the vomer and the intermaxillary ridge below. This cartilaginous portion composes about one-third of the divisional area. It extends from near the junction of the nasal bones at their median line to a point near the tip of the nose, and is more or less intimately attached

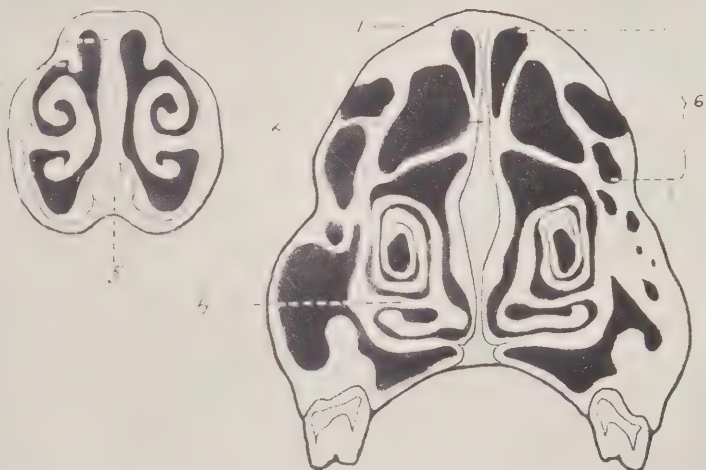


Fig. 2—Vertical sections through nose of a deer; *a*, anterior; *b*, posterior; 1, ethmoid; 2, septum; 3, middle turbinate (no superior turbinate); 4, inferior turbinate; 5, muscular and cartilaginous structure at inferior extremity of nose; 6, ethmoid cells.

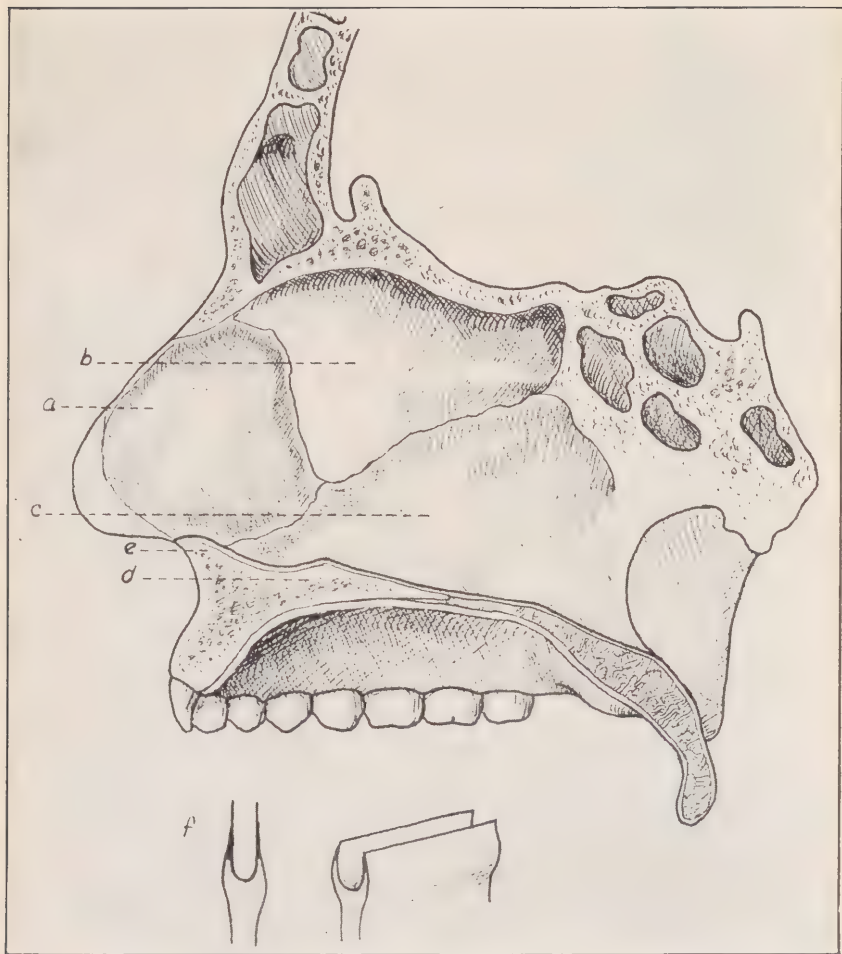


Fig. 3—Diagram showing parts of septum; *a*, triangular cartilage; *b*, perpendicular plate of the ethmoid; *c*, vomer; *d*, intermaxillary ridge; *e*, crest of intermaxillary ridge; *f*, enlargement for triangular cartilage fitting into the moon-shaped groove of bone.

to the nasal cartilages, with an under surface extending from near the nasal orifice along the ridge of the intermaxillary bone. (Fig. 3—Construction of the septum.) Its posterior edge is attached to the vomer, and the perpendicular plate. The cartilage fits into the septal plate of the ethmoid, the vomer, and the intermaxillary ridge by means of a groove, half moon in shape. (Fig. 3, F.) This joint-like surface is of great importance in the study of pathological conditions of the septum, as we shall later have occasion to show, for it is here that injuries cause significant alterations. It should be noted that even with the majority of normal noses the cartilage does not end with the smooth surface at the point of junction with the bones and groove, but sends out spurs, some normal, others individual or pathological. It is to this osteo-cartilaginous structure of the nasal septum that its many malformations are due, some of which involve the cartilage, the bone or both.

The greater part of the septum is covered with a thick and highly vascular membrane made up of columnar epithelium with masses of embedded glands. The less vascular but more highly specialized olfactory membrane covers a limited portion of the upper part. Opposite or a little below the anterior end of the middle turbinate there is a thickening on the septum resulting from an accumulation of glands. This is a danger point in the membrane, which is loosely attached to the septum, easily separable, and as a result easily a seat of abscesses and hematomata.

The nasal mucosa lines the nasal cavities proper but not the vestibule, which is covered by an invagination of the true skin of the ala studded with hairs or vibrissæ. This ciliated epithelium acts defensively against infection. The epithelium of the upper part of the nasal cavities, the olfactory region, is non-cili-

ated, columnar, and highly vascular. Thus the pathology of the membranes of the anterior and upper parts of the nose is quite distinct.

The vascular system of the nose is in close relation with the intracranial circulation. While there are idiosyncratic differences in individuals, it has been the observation of the writer that the greater part of the septal circulation comes from above. (Fig. 4.) The nasal branch of the ophthalmic artery supplies the upper part of the septum; the septal branch of the labial artery and a small branch from the facial artery supply the anterior part of the septum. In addition, the two naso-palatine arteries, derived from the internal maxillary artery, follow the course of the naso-palatine nerves as they pass along the sides of the vomer and enter the septal ridge. Some of the corpuscular elements of the blood exude from the capillaries to the surface of the glandular epithelium and aid in moistening the inspired air.

The nerve supply of the nose is equally extensive with that of the circulation. This has its unfortunate results as well as those more beneficent, for the nose is the source of innumerable reflexes. The naso-palatine nerves enter the septal ridge through the foramina of Scarpa, where they are so deeply protected by bony canals that it is difficult to reach them by anesthetic.

This brief outline of the structure of the nose indicates that we are dealing with a highly complex organ which because both of structure and location is peculiarly liable to derangement of function. These functions, of smelling and breathing, are of such paramount importance in the physical and mental integration of the organism that we shall deal with them briefly before taking up the consideration of the pathology of the nasal septum.

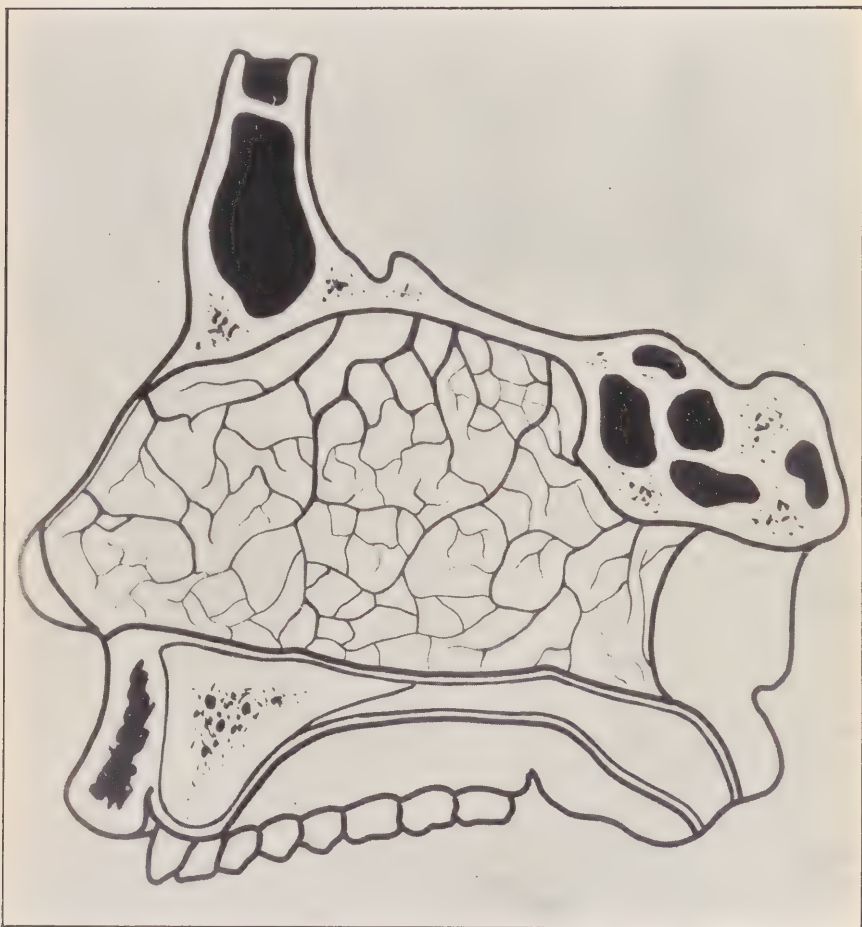


Fig. 4—Reproduction of an injected anatomical specimen from the author's collection showing circulation of the septum.

CHAPTER II

BREATHING AND SMELLING

The nose forms the chief portal to the air passages. In fact, it is with the mouth the forefront of the passages leading to the chief thoracic and abdominal viscera. It exercises a high degree of control over the senses of smell, taste, and hearing. Of the sense of taste, it may be said that it is often true that what we think we taste, we smell. The sense of smell is buried deep in the nose. The Eustachian tube leading from the ear to the recesses of the nose, connects the sense of hearing with the functioning of the nose. It is also connected with the eye by the nasal duct and by close nervous and circulatory relationship, a relation so close that it is estimated that a very large percentage of eye troubles originates in the nose.¹ It therefore becomes evident on even cursory consideration that we moderns have been prone to underestimate the contribution of the nose to our power to adapt ourselves to the world in which we live. It has been estimated that by our neglect to cultivate the sense of smell we have lost by a third the power to remember. Doubly unfortunate, then, are those who by malformation are incapable of using this organ to their health and advantage. It would seem to be a matter of personal welfare to cultivate this organ, which somehow fell into bad repute, to keep it in good condition, and to restore it when it has lost its power of normal functioning.

¹ Thomas H. Curtin, M. D., quoted from lecture delivered on March 5, 1916, before The Lighthouse, N. Y. Ass'n for the Blind.

Normally, the nostrils are open. This patency is constant, and can be increased in forced expirations by the action of the musculo-cartilaginous structure of the alæ, which constitute in part a dilator apparatus. Subjects with over-thin nostrils often have respiratory difficulties. This is especially the case when there is in addition a septal deviation. Atrophy of the structure of the alæ may be accompanied in such cases by hypertrophy of the dilator and contractile muscles attached to the upper cartilaginous tissues.

The region of the nose chiefly concerned in breathing is its lower segment, the part of it below the lower border of the middle turbinate and above the floor of the nose. In inspiration the greater part of the function is carried on between the lower border of the middle turbinate and the lower border of the lower turbinate; in expiration, the greater part of the air comes out through the inferior meatus. That this is true is illustrated by the difficult expiratory breathing when we have enlargement of the posterior tip of the lower turbinate. The writer has observed the truth of these statements in his dealings in New York clinics with silver polishers from the great hotels, in whose noses the path of the air currents is clearly marked by the shadings resulting from the polish they have inhaled.

The functions of the intranasal structures in the breathing process seem to be to warm the air, to moisten it, and to cleanse it by the action of the vibrissæ of the ciliated epithelium. Although there seem to be air paths, as we have indicated, with eddies in the currents set up by individual peculiarities in shape, it may be said that all the surfaces of the nasal cavities come in contact with the inspired air. An exception to this statement is found in the olfactory

region, which, while not closed off from the impact, is sheltered from direct impact by its position high in the nose. Since olfaction is carried on in the upper part of the nasal cavities, it follows that an obstruction in the upper part of the nose will affect smell. For the same reason, since respiration is carried on in the lower region of the nose, the high obstruction will not at the outset affect respiration.

Smelling cannot be carried on independent of breathing, although the inferior or lower part of the nose is chiefly concerned in the one case and the superior or upper part in the other. On the contrary, smelling is dependent upon breathing. Before the scent of any object can be detected the scent-laden particles of air must go through the narrow slit between the middle turbinate and the septum known as the *sulcus olfactorius*. (See the drawing of the deer's nose. Fig. 2.) This narrow passage is the gateway to the sensory area of the nose, itself a small saddle-shaped membrane lining the roof and sides of the upper nasal cavity and out of the direct path of the air-currents which lead to the posterior part of the nose.

In order to produce an olfactory response the odoriferous substance must be placed in the field from which the air is inspired. The olfactory cell bodies lie in the sensory membrane, the peripheral process of each cell consisting of a number of hair-like structures which project into and slightly beyond the membrane. The other end of the cell gives rise to the nerve fiber, which can be traced upward through the sponge-like bone of the cribriform plate to end around cells situated in the olfactory bulb of the brain.

The olfactory bulb and tract lie beneath the *sulcus rectus* on the frontal lobe of the brain. The study of comparative anatomy gives phylogenetic evidence that

the first stages in the development of the cortex cerebri occurred in connection with the distance receptors for chemical stimuli, that is, in connection with sensitiveness to smells. The olfactory apparatus even in mammals exhibits a neural architecture of primitive pattern. The cell which conducts impulses to the brain from the olfactory membrane in the human nose resembles cells in the skin of the earthworm in that its cell-body lies actually amid the epithelium of the skin-surface and is not deeply buried near or in the central nervous organ. Moreover, one and the same cell by its external end receives the stimulus and by its deep end excites the central nervous organ.¹

Minute particles by their impact upon the termini of the olfactory nerve processes produce the sense of smell. These receptors react to every minute chemical stimulus, probably gaseous particles given off from the stream of inspired and expired air coming into contact by diffusion with the olfactory membrane. The chemical stimuli to which the receptors for smell react are for some substances from 1 to 20,000 percent more sensitive than those of taste, although Zwardemaker's olfactometer shows marked variability in individual threshold capacity, with a lowering of the threshold in fatigue in many cases very marked. Hysteria and neurasthenia play their part in disorders of this sense as in the case with other faculties.

This brief description of the nose and its work is given in part to help us visualize the nose as one of the main receptive organs providing data for the rapid and accurate adjustment of the human animal to conditions of time and space, and to show more clearly the need for care in the preservation of the functions so

¹ Sherrington, Charles S.: *The Integrative Action of the Nervous System*. Lecture IX. See also Sherrington's article on "Brain," 11th Ed., *Encyclopædia Britannica*.

necessary not alone to happiness but to health. A normal nose aids in the coordination of the activities of the trunk with the requirements of the head. Sherrington calls attention to the fact that the olfactophrenic respiratory arcs exemplify the integrative function. The nerve fibres from the cephalic receptors end in the grey matter of the central nervous axis not far from their own segment. Thence the conducting arc is continued backward by another strand of fibres, and these reach the mouths of the final common paths in the grey matter of segments of the spinal cord. The ramifications of the neurones attached to the smell receptors are so extensive and the reactions they excite are so far-spreading that their association with the reactions and mechanisms of other receptors is especially wide-spreading. It is for this reason that the training, or perhaps better the reclamation of the sense of smell can affect the memory and bring back from the unconscious so much of the past.

CHAPTER III

COMMON SEPTAL DEVIATIONS

Ideally, the nasal septum is perpendicular. As a matter of fact, among individuals of the Caucasian race, it is seldom quite median. If any judgment can be based on the number of applicants for correction of deflections, it may be said that negroes are comparatively free from such deviations. Morell Mackenzie found that asymmetry existed in nearly seventy-seven percent of 2,000 Caucasian skulls examined. It is the opinion of the writer from his observation of cases entered in New York hospitals that fully seventy-five percent of all cases entered present septal deformities of more or less serious character.

In general, when we speak of a "deviated septum," we mean the exaggerations of the departure from the median which are pathological or obstructive. So long as the deviation is slight and causes no interference with breathing or with drainage from the sinuses, it is of little importance except perhaps from an æsthetic standpoint. Only deviations so pronounced and pathological as to call for surgical interference are the subject of this study. Among the chronic troubles resulting from their neglect are the following: Interference with breathing, obstruction of the drainage of the sinuses, pharyngitis, laryngitis, and catarrh of the middle ear. Ear difficulties almost always occur on the side on which there is interference with breathing,

when the difficulties are the result of septal deviations.

In a consideration of the etiology of septal deviations, the writer as a result of his own observation finds himself in agreement with Killian that the majority of those calling for surgical procedure are traumatic. There are others, however, which can be grouped under the descriptive term "developmental."¹ In the absence of a definite history, such a distinction is difficult. Except in the case of bowed deviations associated with a high arched palate, it is very probable that many supposedly developmental deviations are actually traumatic. This would be more true of boys than of girls because of the more violent sports of boyhood. There can be little doubt that with the extension of the present movement for the physical examination and care of school children, a connection will be uncovered between these deviations and retardations in development, but too early operation on growing children for such difficulties is to be deprecated. Such operations should be deferred until they have reached fourteen years or even later.

As it has been found that the resection of the septum relieves an imposing number of cases of hay fever and asthma, the writer ventures into this perplexing neurological field. In a general way, these diseases are classified as nasal reflex neuroses in which there is present hyperesthesia of the nasal mucous membrane—probably in the ethmoid region.

The work of Pavlov, Bechterew, Cannon, Crile and others has placed on a scientific basis "what has been known empirically for centuries, that emotional factors are capable of producing acute as well as structural alterations * * * as well as being constantly opera-

¹ Porter, W. G.: *Diseases of the Throat, Nose and Ear*. 3rd Ed. Revised under the editorship of A. Logan Turner, 1919, p. 121.

tive in causing so-called functional disease."¹

Neurologists hold that asthmatic attacks may have their exciting causes at any one of the three levels, physico-chemical (autonomic), sensori-motor, or psychical. On the sensori-motor level the inducing cause may be pressure on laryngeal or bronchial nerves, or reflexes from the nose. The problem therefore in treating asthma is first to find which level is chiefly involved. It is here that a future lies for inter-relational therapy. It is possible that such baffling disorders as horse and cat asthma may derive their psychogenic etiological factors from the unconscious odor associations to which we have already referred (Chapter II). A union of forces among the branches of medicine and therapy will accomplish much to clear up such obscure cases and give relief to the unhappy victims. But before that time comes the surgeon has it in his power to benefit many cases. In narrow noses dust particles, steam heat, tobacco smoke, and other like irritations increase the hyperesthesia. It is a matter of record that there have been more nasal difficulties since the building of the New York City subways, with their dust and stale air. In order to properly treat these cases free passage for air through the nose must be provided, and this often calls for the correction of septal deviations.

Various attempts at classification of septal deviations have been made. In view of the fact that so many of the deviations are traumatic, it is evident that we are dealing with such variables as the direction of the original blow, the resistance offered, the location of the trauma, the age of the victim, etc. We shall endeavor to clarify our description by classifying devia-

¹ Jelliffe, Smith Ely, and White, Wm. A.: *Diseases of the Nervous System*. 3rd Ed., 1919, p. 122.

tions as (1) bowed or curved, and (2) angular. To aid in visualizing them they may be called S-deviations and Z-deviations, picturing these letters as crossing the median line of the septum. Such a rough general classification is an attempt to distinguish between the results of fracture and bending. It is evident that traumatic cases would most often fall among the Z-deviations, while the S-deviations would include along with traumatic deviations the greater number of so-called developmental deviations. There are, however, nondescript cases in which the bone and cartilage have been so injured and dislocated by the blow as to fall under neither of the suggested headings. Because of their special problems we shall later describe the surgical procedure necessary in dealing with such cases.

When we recall the distribution of function among the anterior and lower part of the nose, the posterior part, and the upper part, it will be evident that high deviations of either class do not cause interference with breathing experienced by those who have obstructions in the lower or anterior part of the nose. These anterior obstructions, some of which are almost horizontal, turn the air currents from their accustomed paths. In many of the S-deviations we find deflections of both bony and cartilaginous portions of the septum, many of them more marked anteriorly and curving out toward the turbinates in such a fashion as to interfere seriously with normal breathing. (Fig. 5-a.) In such a type the lower part of the curve is often sharper, causing greater difficulty with this function than in the case of the upper curve. It is the higher curve that interferes with drainage and that is more apt to cause nervous symptoms. The line of deflection in these S-deviations is anterior-posterior, or along the perpendicular line, instead of being almost horizontal

as in many of the Z-deviations. In crossing the median line the deviation causes the blocking of both passages, with a marked low obstruction on the one side, a slighter high obstruction on the other. The variations in the S-type are not apt to be so extreme as in the Z-deviations, although the reservation must be made that there have been cases observed by the writer of the S-type which were so twisted as to approach the horizontal rather than the perpendicular plane. Because the S-deviations are more often true to type they form the basis for the operation described in Chapter IV. The special procedures will be described in Chapter V.

The angular, or Z-deviation, is an exaggeration of the curved or S-deviation, and presents more anomalies. As in the S-type, the anterior deflection is more marked and is apt to be sharper than the posterior deflection. The original trauma may have resulted in fracture, with dislocations, blood clots, etc. (Fig. 5-b.) These deviations are frequently associated with crests or ridge on the septum, usually a little above the floor of the nose and commonly along the line of the junction of the intermaxillary ridge, the triangular cartilage and the vomer, running upward and backward from the nasal spine. These ridges are sometimes very large, extending into the nasal cavity so far that they are in contact with the lower end of the inferior turbinates. They may be bony or cartilaginous or both, and always present difficulties in surgical procedure.

The muco-perichondrium covering the septum is normally easily separable from the septum. Its point of least resistance to injury is near the center. If a fracture occurs at this point it is often followed by hemorrhage. In the healing process the clots frequently become the centers of growths and adhesions,

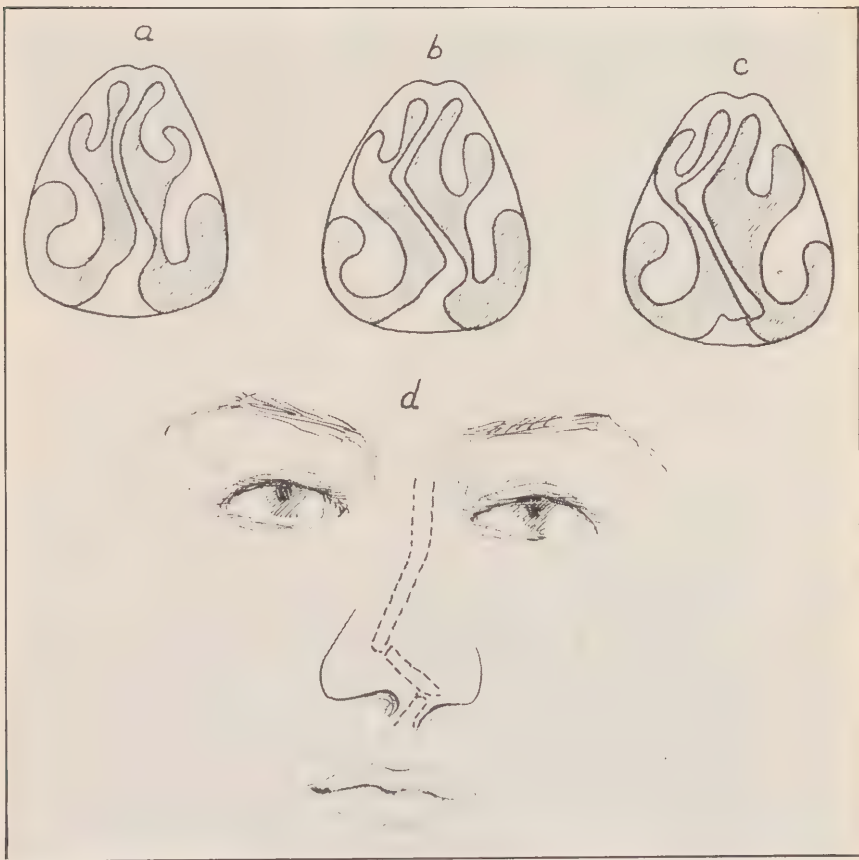


Fig. 5—Diagrams of typical deviations; *a*, S-deviation; *b*, Z-deviation; *c*, nondescript, with dislocation; *d*, fracture.

themselves obstructions and centers for further abnormal growths as time goes by. These thickenings and adhesions, accompanied by tension of the membrane, are the source of operative problems. The membrane on the convex side is liable to atrophy, as in the case of all convex surfaces.

It is evident that the Z-deviations are more involved, present more anomalies, and call for more variations in surgical procedure. In one of the more common variants of this type there is a low angular deflection which crosses the median line low in the nose at what approaches a right angle, returning to the perpendicular posteriorly with a wider angle. (Fig. 5-d.)

In both the S-deviations and the Z-deviations, as a rule, a low ridge obstructs the inferior and middle meatuses on the narrow side, while the other side is left too wide open, with the result that the inferior turbinate is often enlarged. The upper bend often forces the middle turbinate outward, thus causing obstruction to the drainage of the superior meatus and accessory sinuses. The lower part of the deviation presses against the inferior turbinate anteriorly, not as a rule posteriorly, while the upper curve presses against the middle turbinate anteriorly or for nearly its whole length. The posterior part of the obstruction is often bony and is usually covered with cartilage, while the spurs also are both bony and cartilaginous.

There are cases in which the force of the original blow was great enough to dislocate the septal cartilage from the moon-shaped groove into which it was originally fitted. The cartilage would then fall on one side or the other of the ridge, depending on the direction of the blow, and the groove would gradually be filled in with fibrous tissue. (Fig. 5-c.) Another result of this dislocation would be thickening and spurs, with an

elongation of the cartilage. Cases of curved deviations accompanied by a sharp spur and a groove are especially difficult from the surgical point of view because of the danger of tearing the membrane.

Sometimes the septum has been torn loose in the anterior portion and pressed to one side. (Fig. 5-*d*.) As a result of such a dislocation part of the cartilage often lies in a position approaching the horizontal across the inferior meatus. Part of it may cross the median line and partially block the vestibule of the open side of the nose. In a good many of such cases the dislocated portion of the cartilage is separated from the rest of the septal cartilage by the fracture, the gap between the parts being filled with fibrous tissue. This creates a difficult situation and necessitates a variation in the technic of the ordinary operation.

It is not to be understood that this chapter has exhausted the possible varieties of classification of septal deviations. All that has been undertaken is to simplify the description of the results of trauma and resultant malformation in order to work out a method of procedure for the simpler cases, which can be modified to fit the less ordinary cases. With these facts in hand the procedure in the classic operation for curved or S-deviations will be better understood and more easily modified to meet involved situations.

CHAPTER IV

SURGICAL PROCEDURE IN THE SUB-MUCOUS RESECTION OF THE NASAL SEPTUM

The operation now most frequently used for correction of the deviations of the nasal septum which we have described in Chapter III and which are remediable by surgery is an outgrowth of the work of Killian, Ballenger, Freer, and others in the early years of this century.¹ In the last decade the technic has been perfected by improvement and adaptation in the tools used, by modification of the incision as the result of experience, greater care in the selection of cases, and a lowering in the time of the operation. Operators specializing in this field lay increased emphasis on a knowledge of the anatomy, circulation, and neurology involved in a favorable prognosis. It is because of progress in these interrelated fields that the technic of this operation has reached the stage of perfection now attained.

The present-day submucous resection operation superseded the earlier crushing and sawing operation of Asch and others. The older operations were productive of great shock with consequent traumatic disturbances, sometimes of long continuance. They were

¹ See Ballenger, Wm. L.: *Diseases of the Nose, Throat, and Ear*. 4th Ed., Phila. and N. Y., 1908. Article by same writer, *The Submucous Resection of the Septum Arranged by Steps*. *The Laryngoscope*, April, 1906, Vol. XVI, No. 4.

Freer, Otto T.: *The Correction of Deflections of the Nasal Septum with a Minimum of Traumatism*. Reprint, *Journal of the American Medical Association*, March 8, 1902.

too often followed by hemorrhage, and destroyed excessive amounts of membrane with the consequent pathologic phenomena of scar tissue and poor drainage. The post-operative treatment by plugging was painful and sometimes indefinitely prolonged.

The septum of the nose as we have said in Chapter I is composed of the triangular cartilage, the perpendicular plate of the ethmoid, the vomer and the intermaxillary ridge. The triangular cartilage rests in grooves in these bones. Along the ridge of the nose it lies between the lateral cartilages. The part that extends down toward the end of the nose is practically without attachment. It is generally along the moon-shaped groove that injuries to the septum cause significant alterations; and it should be noted that the cartilage sometimes sends out spurs from the grooves, some apparently normal, others individual and pathological. The posterior edge of the septum is attached to the vomer, while the tip of the nose and the nasal ridge are the limits of the under surface. This septal cartilage is covered with a highly vascular mucous membrane of columnar epithelium. The area has an abundant blood supply, part from the nasopalatine arteries, from the nasal branch of the ophthalmic artery, the septal branch of the labial artery, and from a small branch of the facial artery which perforates the nasal bone and further supplies the anterior part of the septum. Because of the extent of the blood supply there is little danger of the parts becoming necrotic.

The indications calling for operative procedure in deviations of the septum have already been described in Chapter III. The procedure described in this Chapter is observed in ordinary cases of curved or S-deviations, with no sharp angles. The operation calls for

local anesthetization and is usually performed with the patient in a sitting posture. The following instruments are necessary; a reflected light; a small scalpel; a nasal speculum; a packing speculum; Dunning's combination curette elevator; a Ballenger swivel knife; punch forceps (two styles); a small chisel and mallet.¹

The patient should have spent the previous night in the hospital or under equally quiet conditions. After a good meal, preferably an hour and a half to two hours before the operation, he is seated and his nose cleansed for anesthetization. It is impossible to cleanse the nose thoroughly because of the many openings, but we are aided by the fact that the nose is singularly free from infection. Unless there is indicated some idiosyncrasy to cocaine, that drug is used as an anesthetic. A nervous condition in the patient will predispose to cocaine poisoning; for this reason the writer prefers a weak solution, about equal parts of cocaine, ten percent, and adrenalin chloride 1-1,000. If anesthetization takes longer than the average of about twenty minutes, weaken the solution to four percent. Ballenger and Freer reduced the time for anesthetization by the use of pulverized cocaine with a 1-2,000 solution of adrenalin. This reduces the time; but the writer believes that many of his colleagues will agree that the economy of time is made at the grave danger of cocaine poisoning from drifting crystals, when the powdered cocaine is used.

Complete and speedy anesthetization may be induced by care in the placement of the saturated plugs.

¹Yankauer says that the ingenious Ballenger swivel knife like the original cartilage knife of Killian, leaves a strip of cartilage on the crest. To obviate this he uses a hook-shaped separator, with a pair of forceps with hollow blades to cut the cartilage. The writer has found that this strip presents no particular difficulty, as it can be removed with ease by a curette. In later operative work he has used a heavier chisel and mallet than in earlier years.

Place the first plug, thoroughly moistened, high under the superior turbinate. This is often difficult because of the shape of the nose. Lay the next plug above the lower turbinate and on the middle turbinate. Place the third as far underneath and posterior to the lower turbinate as it can be placed, well back toward the pharynx, leaving a generous length to fill the anterior part of the nose. The skin of this part of the nose is affected through the circulation. Injection is never necessary if adequate time and care are given to this stage of procedure.

Much of the success of anesthetization is dependent on the careful orientation of these saturated plugs. If we recall the nervous system of the nose we know we are to reach the nerves above coming in from the cribriform plate as well as the ganglia of the sphenopalatine system. The second and third packings are so placed as to carry the cocaine posteriorly. In that region the septum is completely covered, and is bleached and hardened by the process to the consistent texture of a linen handkerchief, or perhaps better, of a tanned hide.

After anesthetization is complete, the plugs are removed and the surgical procedure is initiated by incision. For convenience and therefore for speed and dexterity, the incision is made on the left side.

Much of the content of the earlier literature dealing with this operation on the septum is devoted to the character and position of the incision, or incisions. The old incision made at the tip of the nose is known as the Hajek incision (Fig. 7); the one at the junction of the vestibule skin with the mucous membrane, the Killian incision. The latter incision was used by Ballenger except when the septal cartilage was deflected at the tip, when he used the Hajek incision. Krieg had made a U-shaped flap with three incisions.



Fig. 6-b—Dunning Elevator.

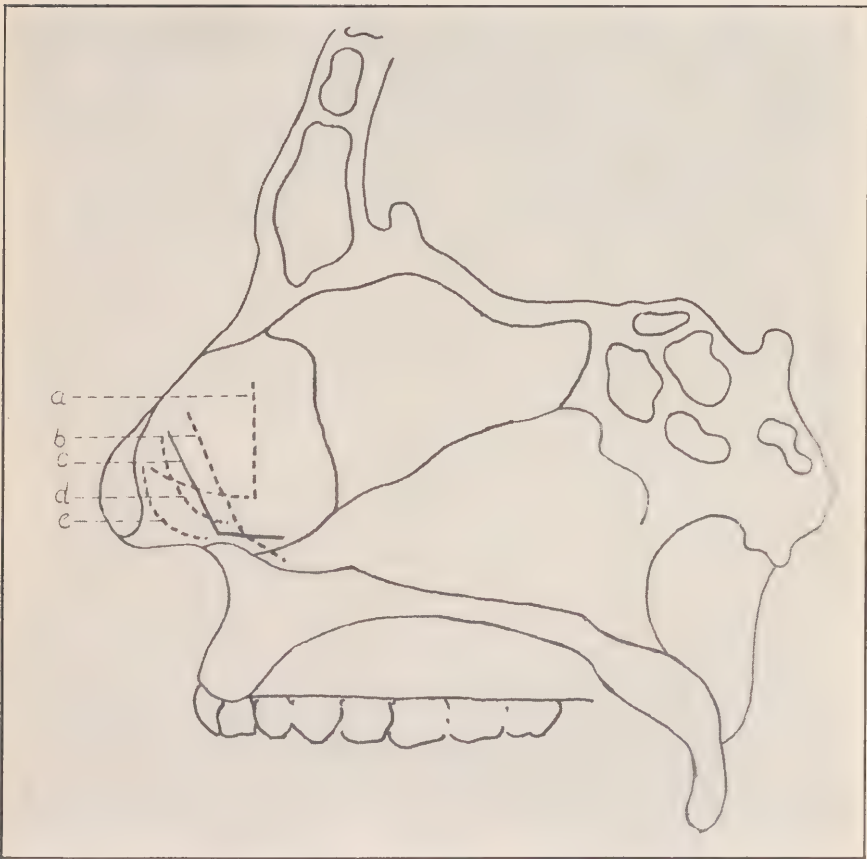


Fig. 7—Diagrammatic representation of incision; *a*, Freer; *b*, Yankauer; *c*, Dunning; *d*, Killian; *e*, Hajek.



Fig. 8—Showing position of patient and scalpel at moment of incision.

But observation of the secondary results of this operation showed that the problem was to avoid scar tissue that would interfere with one of the main functions of the septum, to facilitate the drainage accomplished by the capillary attraction between the secretions and the ciliated epithelial surfaces. If a thick horizontal band of squamous epithelium is formed by the operation, the flow of mucus is impeded, dries, and forms crusts. This called for the reduction to a minimum of the amount of scar tissue. Other modifications of the earlier incisions were concerned with the avoidance of perforations. It had been found that the largest number of these perforations had taken place with the flap incision. Hajek had made a single curved incision in the mobile septum along the anterior edge of the cartilage; but his operation left the dorsum of the nose supported by a strip of cartilage whose only attachment, the notch between the nasal bones, was very weak. Killian had made a curved incision in front of the deviation with the convexity forwards. But in the more severe deviations the management of the lower part of the septum is "most difficult," to use his own words.

Years of operating have taught the writer that the most successful operations result from a vertical incision anterior to the white line appearing very distinctly in the anesthetized nose, at the point of junction between the mucous membrane and the true skin. This line, anterior to the Killian incision, is used as a guide in order to get a tougher membrane and to remove the anterior deviations if they exist.

In making this incision, the knife is inserted through the mucous membrane, to, but not through the cartilage. The cut is started about one-fourth of an inch from the roof of the nose, and prolonged downward to

the floor and outer wall, the deep L-incision being completed at the close of the operation for drainage purposes, and to lessen the danger of atresia. (Fig. 8.)

The incision made, we elevate the muco-perichondrium from the cartilage by the use of the curette end of the elevator. This blunt instrument is safer, in order to avoid tearing. Starting at the highest angle of the incision and changing to the flat end of the elevator, we push gently backward, upward, then downward. (Fig. 9.) In the majority of cases we are able to separate the mucous membrane from the cartilage, and from part of the perpendicular plate of the ethmoid with this stroke from behind forward. Then scraping through the cartilage at a point posterior to the incision and near the lower limit of the cartilage, as illustrated in Figure 10, turn the curette so that its back lies on the membrane of the other side and scoop out the cartilage by a forward and upward stroke. This process should be completed along the line posterior to the incision in order to avoid perforation opposite the incision at that point, if one is so unfortunate as to go through the membrane of the opposite side. The next stage is the complete separation of the muco-perichondrium from the septum on the opposite side, with the same procedure. When this is done the deflected cartilage may be removed either with the Ballenger knife or with forceps. (Fig. 11.) The operator should use great care at this point to avoid any use of force, in order not to dislocate the septal cartilage from the lateral cartilages or at the junction of the perpendicular plate of the ethmoid. These aid in the formation of the bridge of the nose.

If the deformity is not corrected by the removal of the cartilage in the way described, a cutting forceps is next inserted through the incision. Bite with this for-

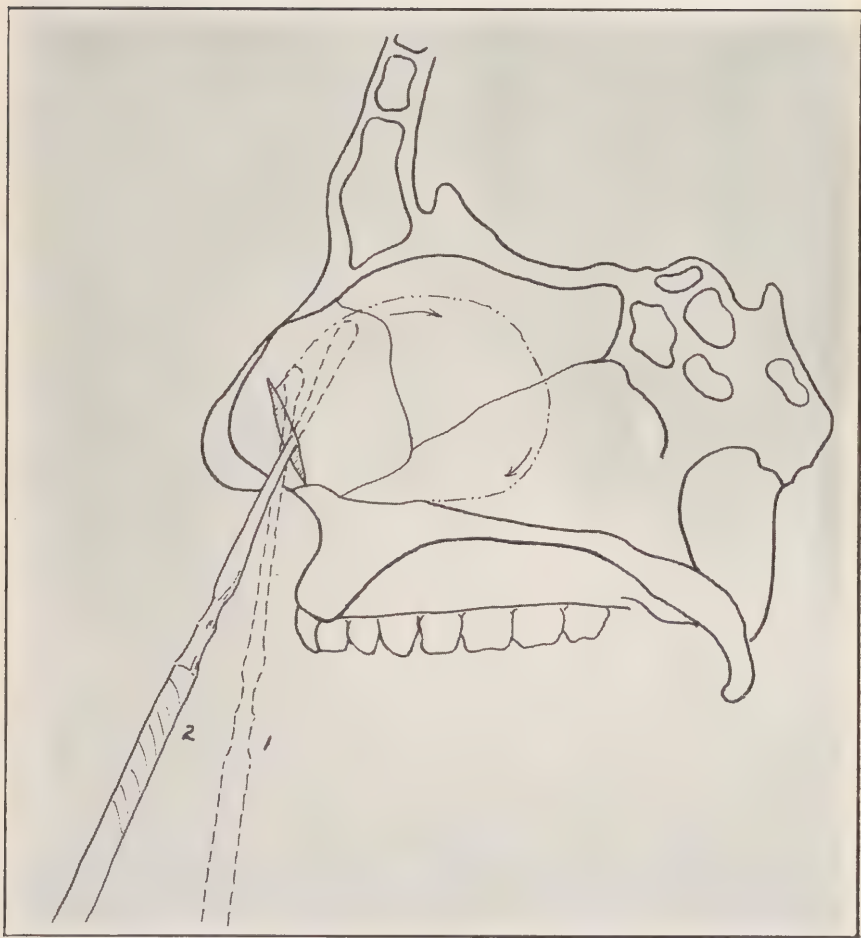


Fig. 9—Showing positions of curette elevator; 1, curette end; 2, elevator end; dotted line of direction with arrows indicates direction taken by instrument in loosening membranes.

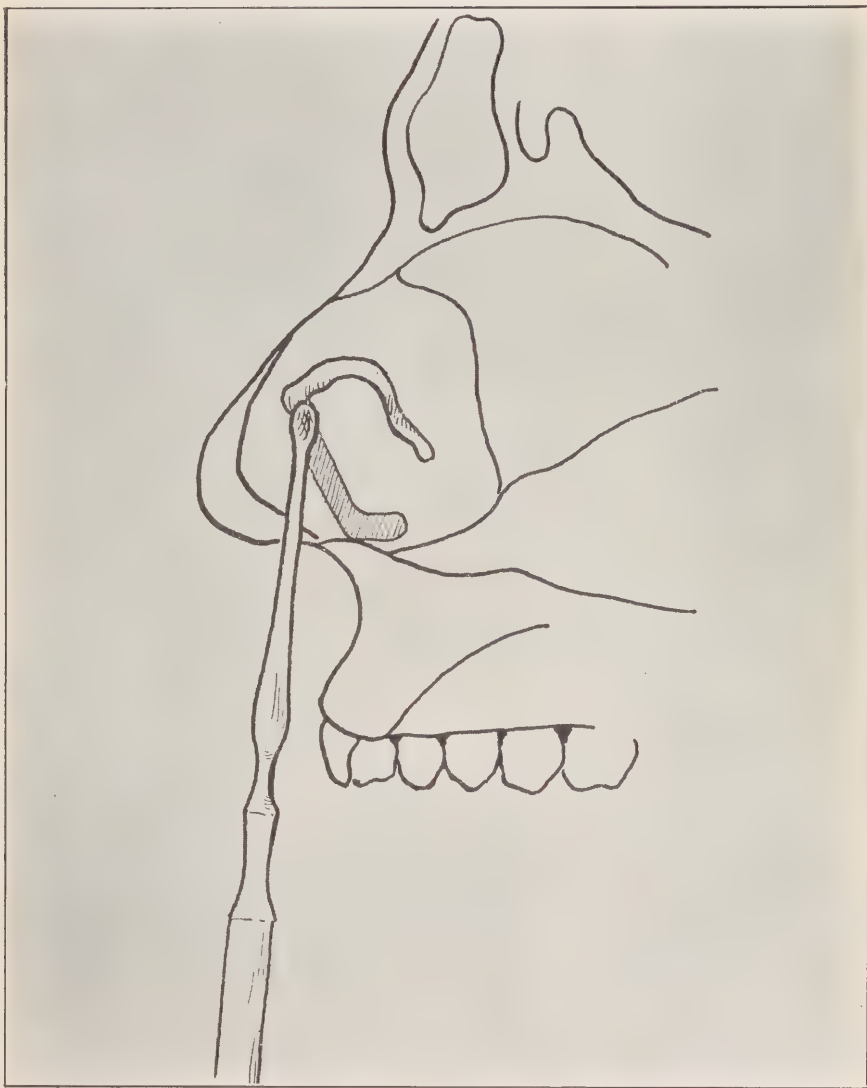


Fig. 10—Showing curette scooping cartilage in cavity at beginning of operation.

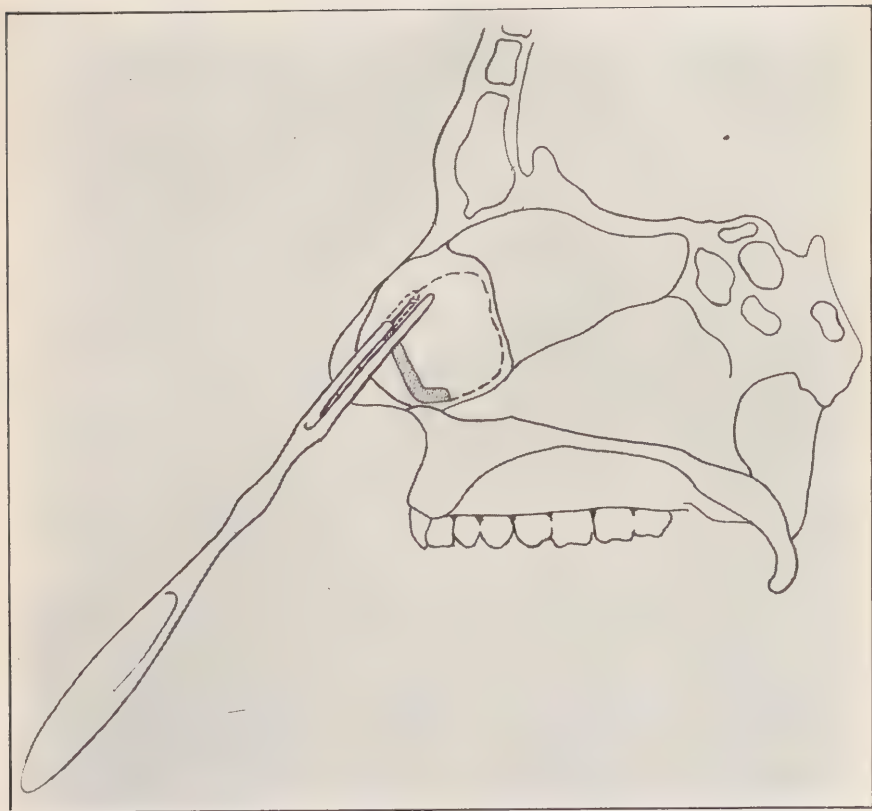


Fig. 11—Showing position of Ballenger swivel knife at point of entrance. Dotted line shows direction taken by knife.

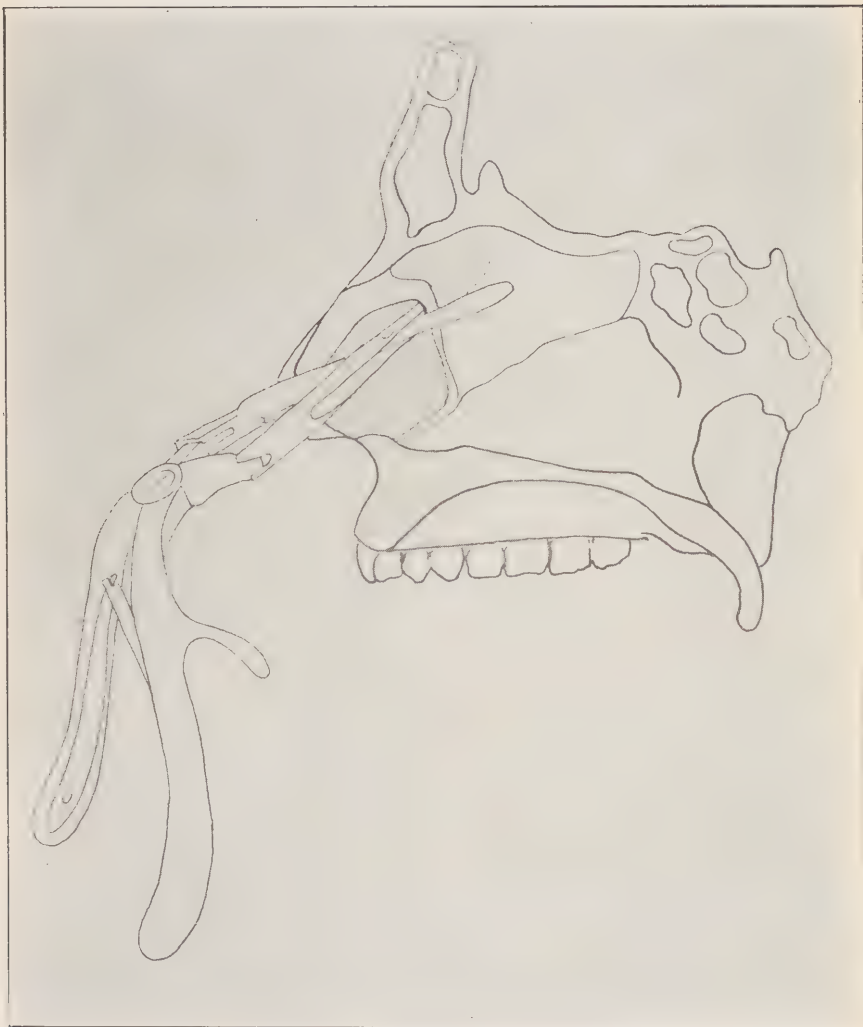


Fig. 12—Showing use of punch forceps after removal of cartilage and starting removal of bony structure.

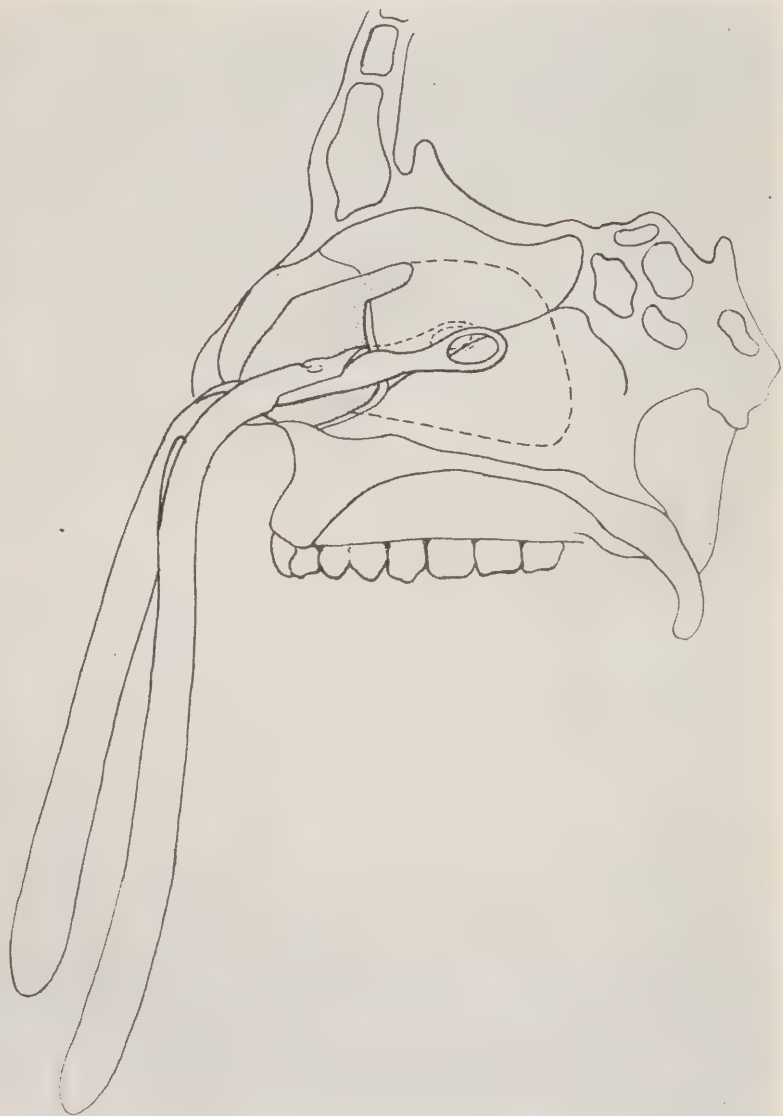


Fig. 13—Continuing Fig. 12 at late stage in removal of bone by punch forceps.

ceps through the junction of the perpendicular plate of the ethmoid with the cartilage at the highest point. (Fig. 12.) The surgeon must exercise great caution at this point to avoid fracture of the cribriform plate,—a danger against which one can easily guard. The perpendicular plate of the ethmoid and any part of the vomer causing obstruction is removed (Fig. 13) with the aid of a punching forceps. The incisor crest usually causes more or less obstruction; here also is often found a large amount of fibrous tissue and adherent membrane, especially at the junction of the perichondrium and the periosteum. After the cartilage lying above is removed, these may be separated by a sharp knife, if one will remember to keep the sharp edge of the knife on the incisor crest. (Fig. 14.) The incisor crest is then removed with a chisel and mallet. It should be remembered that the incisor crest extends well forward; if, therefore, the chisel is inserted well down on the crest and driven upward it will separate with the exertion of very little force. (Fig. 15.)

On the removal of the incisor crest, together with the other bony and cartilaginous portions of the septum, there is left a roomy opening between the membranes. The operator has now to deal with the intermaxillary ridge, which is thin below its junction with the triangular cartilage. If the chisel is inserted so that it reaches the ridge, with one or two slight taps the bone can be fractured for considerable distance posteriorly. (Fig. 16.) It is then easily removed with a curette or with forceps.

The division of the membrane is now continued at its outer angle for a little more than one-third of an inch, posteriorly, to facilitate drainage and relieve danger of atresia. The sac is thoroughly cleansed.

the blood clots and any remaining pieces of cartilage and bone are removed. Replace the mucous membrane on the septum. The septum is lined to see if there is any remaining deviation; if not, the membrane is replaced in position. (Fig. 17.) It will be found that the membrane has contracted; because of this there is but little danger of hematoma. The healing process will be aided by the drainage of the end of the L-incision.

The surgical procedure in an uncomplicated case of curved deviation is now complete. The nares are packed with vaseline gauze, which is left in place for twenty-four hours. Care should be exercised in packing that the gauze is placed not too far posteriorly, in order to avoid irritation of the Eustachian tube and also to avoid follicular tonsillitis. After the removal of the gauze, the patient is instructed to insert white vaseline in the nose. A few crusts will form; these should be removed about once a day. There is little reaction from this operation, and the patient is usually able to return to his ordinary pursuits in about forty-eight hours after the packing is removed.

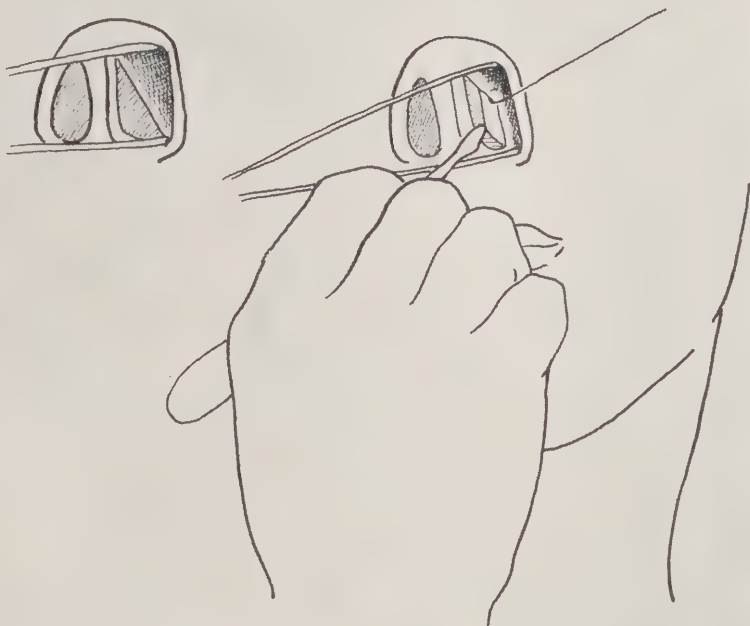


Fig. 14—Diagrammatic explanation of procedure with speculum and scalpel in place in separation of membrane from bone on floor of nose preparatory to removal of portions of incisor crest and intermaxillary ridge.

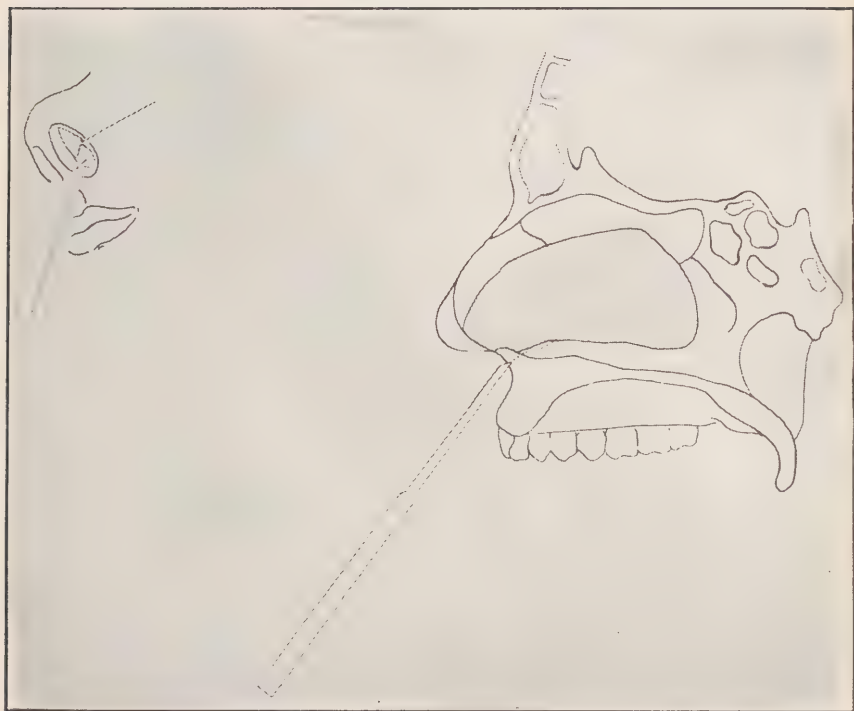


Fig. 15—Showing procedure with chisel and mallet in removal of incisor crest.

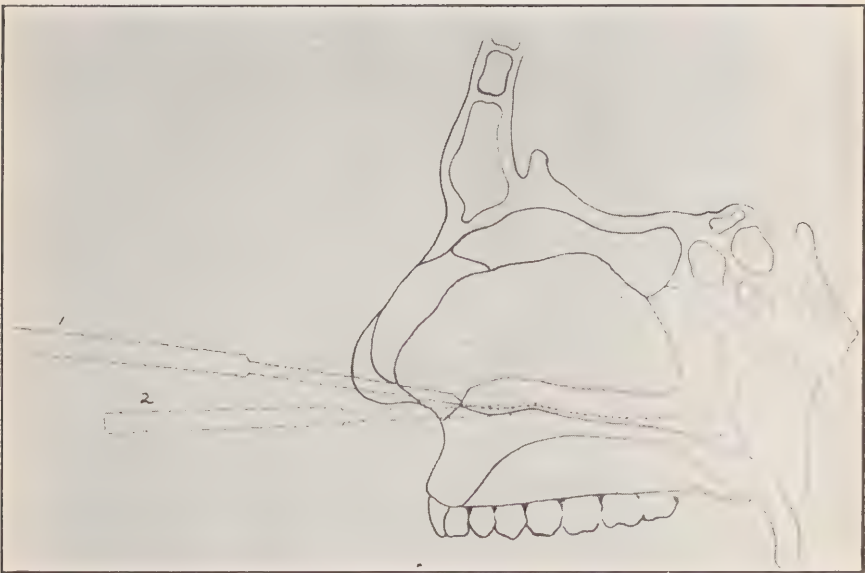


Fig. 16—Showing later stage of procedure with mallet and chisel in removing portion of intermaxillary ridge; 1 and 2, show instrument's change of position—chisel not driven so far usually, as indicated in diagram.

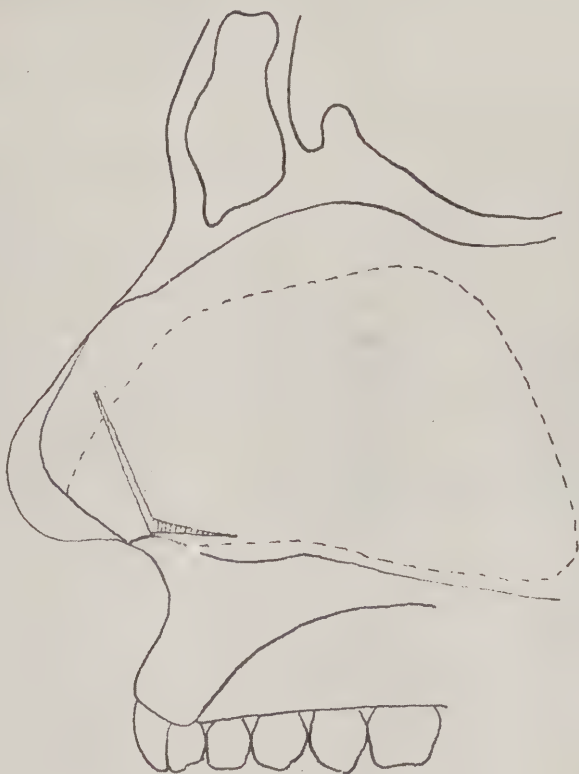


Fig. 17—Diagram showing completion of L-incision.

CHAPTER V

SPECIAL SURGICAL PROCEDURE

In the previous chapter we have described the surgical procedure to be followed in the more typical cases of septal deviations. But in these cases, as in all operative work, the surgeon often finds unusual conditions which tax his skill and ingenuity. Some of these exceptional cases occur frequently enough in a long experience to establish a procedure that may itself be standardized. We shall describe some of these cases, with suggestions as to ways to meet the special conditions.

There are deviations of the nondescript type which exhibit a well-marked spur or ridge. In these cases it will be found that the septum after being thrown out of the normal position has bowed, so that it is convex on one side, and more or less concave on the other. These spurs commonly have at their extremities well-defined crests. On the concave side, toward the anterior part of the nose, there is more or less of a gutter, the depression becoming more marked in the posterior region. This ridge and depression are found to extend back in most cases over about two-thirds of the length of the septum.

In special cases of this ridge and depression type, the incision is made at the usual position, as described in Chapter IV. If the concavity of the septum occurs on the left side, the muco-perichondrium is first separated from the crest very carefully with a small knife of the Ballenger type. The original incision is then

prolonged to the outer side of the nose near to and a little forward of the lower tip of the inferior turbinate, as in the regular procedure. The flap will then lie at an acute angle, leaving abundant space—a very necessary requirement in these cases calling for extra caution. The loosening of the membrane should be done with great care, using the curette end of the elevator, as illustrated in Figure 22, and separating very gently with an outward motion from the gutter, at the same time keeping the curette in the groove. The greatest caution will be found necessary at the point of deepest depression, usually opposite the sharpest point of the spur and in a posterior position on the septum.

Such is the procedure when the ridge lies on the left side. In dealing with cases presenting a well-defined groove on the right side, remove with the curette a part of the cartilage just behind the original incision, separate on the concave side, and proceed as before. It is a matter of observation that these spurs are found on the right side in the greater number of cases, and if we recall that they are traumatic in origin the reason is evident because of the ordinary incidence of blows from a human source.

After the removal of the anterior portion of the cartilage, it is well to continue the separation higher up with the curette end of the elevator. There is less danger of tearing the membrane with this instrument. (See Fig. 18, first position.) Then, changing to the other end of the elevator, continue the separation by pushing gently upwards and backwards. There will usually be little difficulty in separating the membrane down to the point on the spur where the convexity is causing tension with consequent thinness of the membrane. (See second position, Fig. 18.)

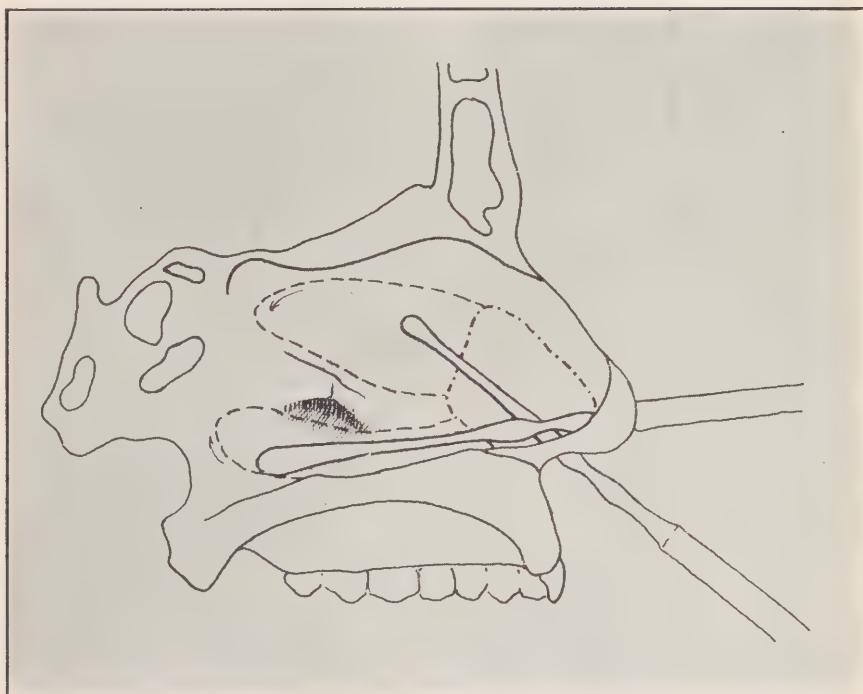


Fig. 18—Diagrammatic drawing showing positions of Dunning's curette elevator in loosening membrane above and below spur.

In the majority of these cases with the spur and ridge, posterior to the sharpest point of the deviation the septum after a gentle curve falls back to the perpendicular. In such noses, smell may be fairly normal except from some secondary difficulty, but breathing is apt to be seriously interfered with. This is because usually the bone behind the spur was not affected by the original injury. But in cases where the bone is affected, the cartilage and bone high up and near the spur may be removed by inserting the Jansen-Middleton forceps and biting them away, as illustrated in Figure 19. This procedure will relieve the situation above the spur. Then take the forceps, go in back of the spur and press down gently. This gentle downward pressure will separate the membranes, which are usually loosely adherent posterior to the spur. This will also break down the posterior attachments of the spur, which, as a rule, extends from a position near the floor in the anterior part of the nose upwards and backwards for a distance nearly half the length of the septum. The situation has so far been relieved back of the spur. We now start in front of the spur and near the floor of the nose to separate up to where the mucous membrane thins again. Bite through at that point with the forceps. (Fig. 20.) By this time the spur is so completely loosened that a gentle push with the curette to the concave side will cause it to separate from the membrane, when it can be removed from the nose without difficulty. (Fig. 21.)

Another case calling for variation from the usual procedure, and almost as common as the spur and groove, is a result of the breaking, or more correctly, the smashing of the septum, with both bone and cartilage involved. As a result of this injury there has been a formation of fibrous tissue with adhesion of the membranes on both sides of the septum. To deal with

these cases, open up the incision in the usual way. Use a curette to gain space. It will usually be found advisable to continue the use of the curette until the line of cleavage has been located. After this point has been reached the usual procedure applies, except that it may be necessary at times to use a knife in loosening the adhesion.

We have already alluded to a type of deviation in which the deflection is almost at right angles to the perpendicular line, with a cul-de-sac formed by dislocation in a posterior position. The formation of fibrous tissue which has resulted completely separates the two severed portions of the septum and unites the muco-perichondrial surfaces. In such a case, make the usual incision and separate the membranes on both sides up as far as the cul-de-sac. Then, with the curette or forceps, remove all the cartilage, except the ridge above. (Fig. 23.) Working high in the nose, separate the membranes behind the cul-de-sac and on the concave side. They are usually not so adherent in this region. Then curette through on a line a short distance posterior to the sharp angle, removing the cartilage but leaving the ridge. After this stage is reached, the procedure becomes the usual one. It is to be noted that in this case there are two curettes through the cartilage, one anterior, the other posterior. When this has been done and the adherent membranes loosened, hook the cartilage at the high point and bring downward and forward with a sweeping motion toward the obstruction. (Fig. 24.)

Inasmuch as it sometimes happens to the most careful operator that he punctures or tears the opposite membranes, it is well to know how to remedy them. The following procedure, devised by the writer, gives excellent results in a large number of cases: Drive a needle, preferably of the style of Yankauer's curved

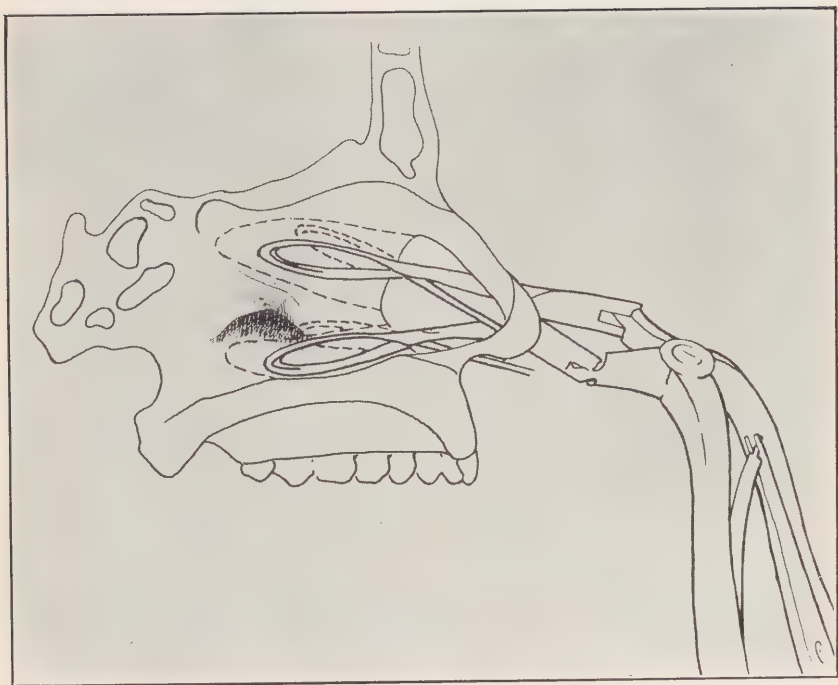


Fig. 19—Showing Jansen-Middleton forceps biting away cartilage and bone above and below spur.

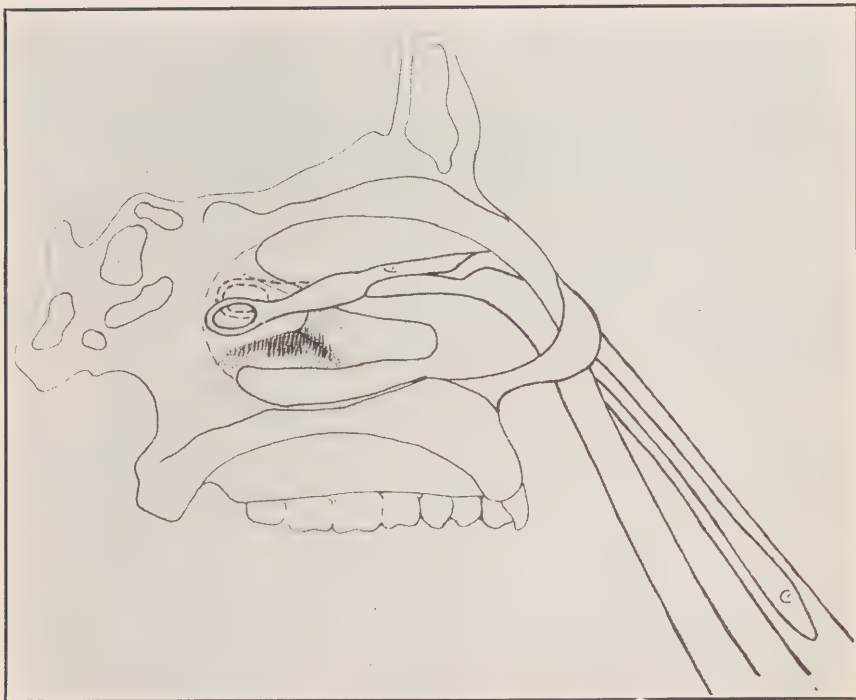


Fig. 20—Showing punch forceps biting away bone and cartilage back of spur.

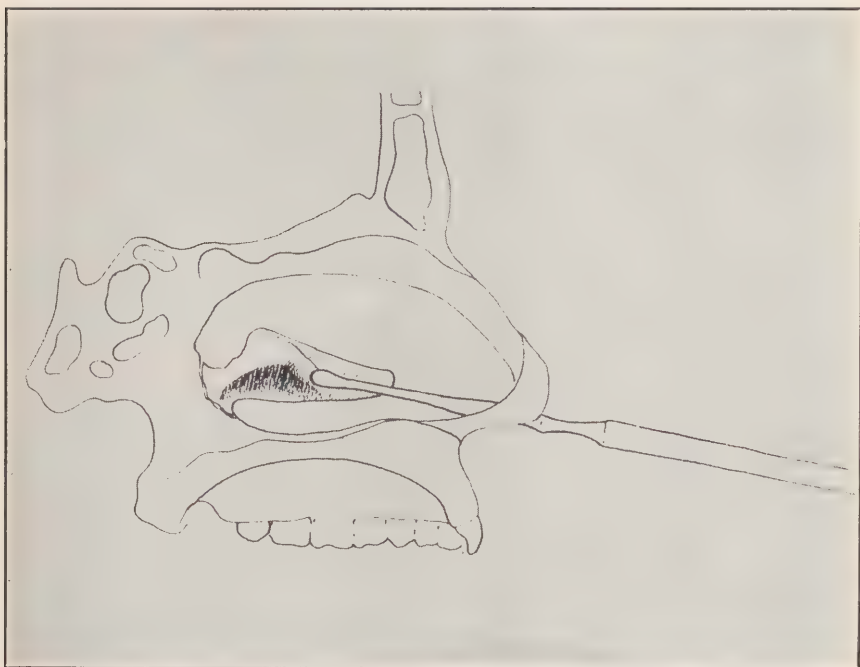


Fig. 21—Showing removal of spur with curette.

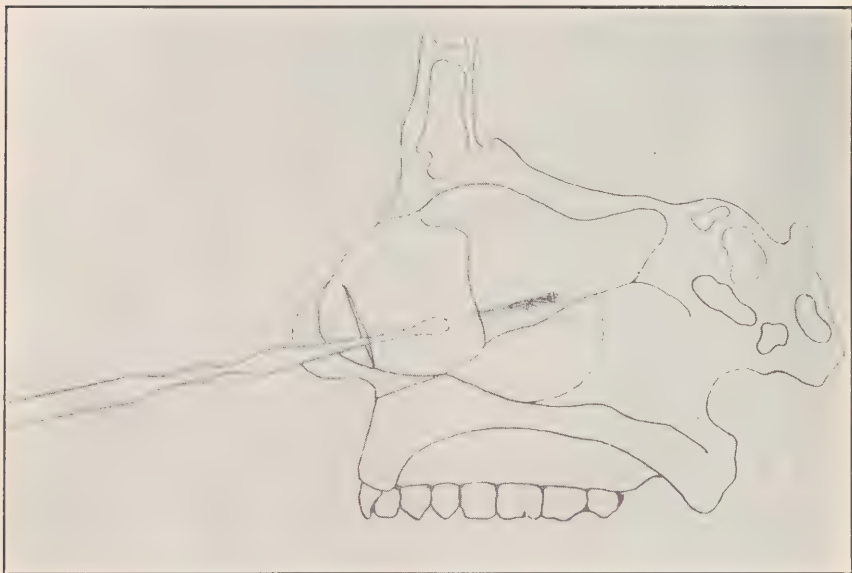


Fig. 22—Showing curette loosening membrane along groove.

suture needle, threaded with silkworm gut, well into the tissue anterior to the incision and low down near the floor of the nose. Then push the needle upwards and backwards so that it will cross the line of the incision as high as necessary in the nose. After the needle is in position, holding the gut with angular forceps, withdraw the needle. If the perforation is small, it is unnecessary to reach as high on the membrane. But if the perforation is large, then separate the mucous membrane as high as the bridge of the nose, cutting with a knife from the side on which the flap is being made, as illustrated in Figure 8. The membrane having been loosened enough to allow the flap to fall into position (see Fig. 25), the suture is drawn with a running loop (see Fig. 25) and afterwards tied with a surgical knot. On account of the free circulation of blood in the septum there is practically no danger of a necrotic flap. Pack the nose lightly and not too far posterior, to avoid ear difficulty, using vaseline gauze. In twenty-four hours the gauze may be removed on the opposite side; in forty-eight hours on the side on which the perforation has been repaired. The suture is left in position several days, until it begins to cut itself out.

It is in these special cases that the operator on the septum finds his greatest difficulties, just because they confront him with unexpected conditions. But patience and skill and a cool head combine with the knowledge of the experience of others to simplify the problem. As these special cases give the greatest difficulty to the patient also and call most insistently for correction, the writer feels justified in the attempt to describe a procedure which calls more urgently for a skillful hand than for language, and which is, therefore, hard to translate from action to words.

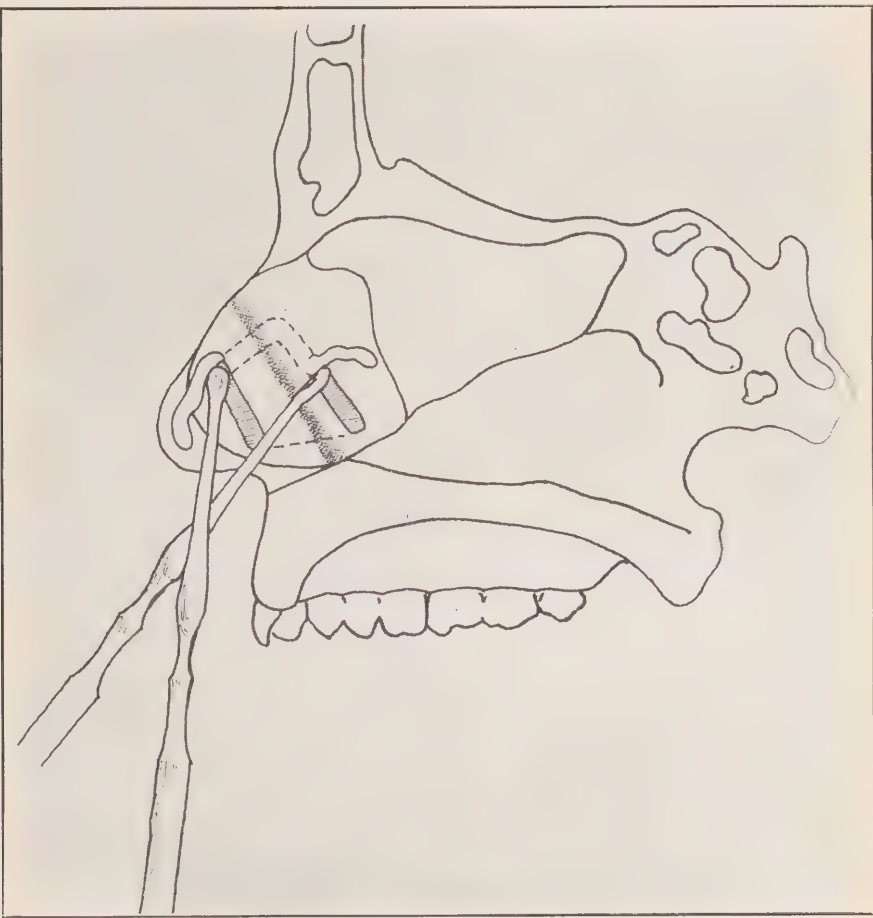


Fig. 23—Diagram showing curette scooping out cartilage on both sides of cul-de-sac.

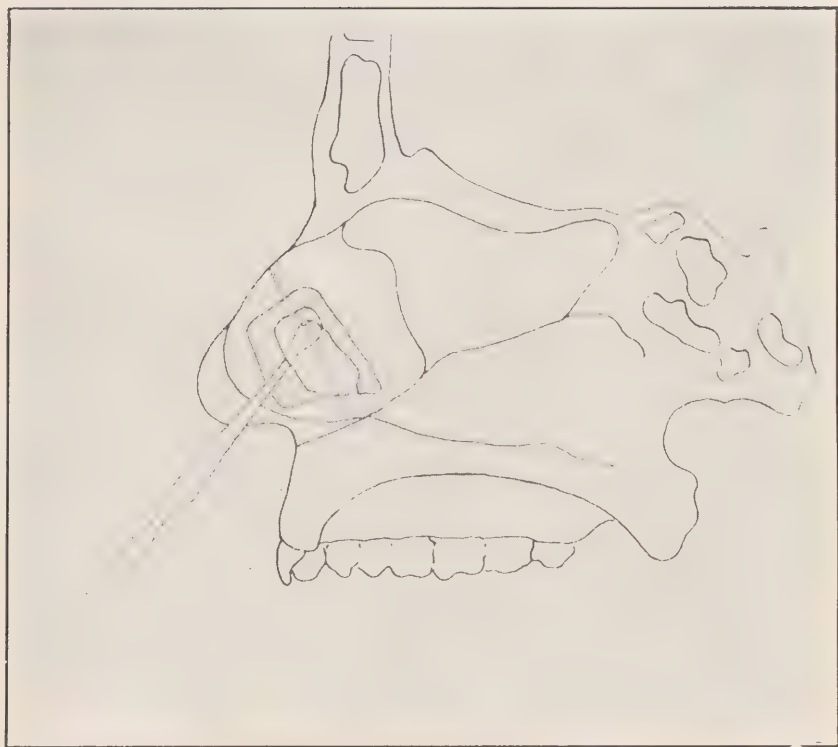


Fig. 24—Showing curette hooking cartilage at high point and removing obstruction, after clearing away cartilage about the base to facilitate breaking.

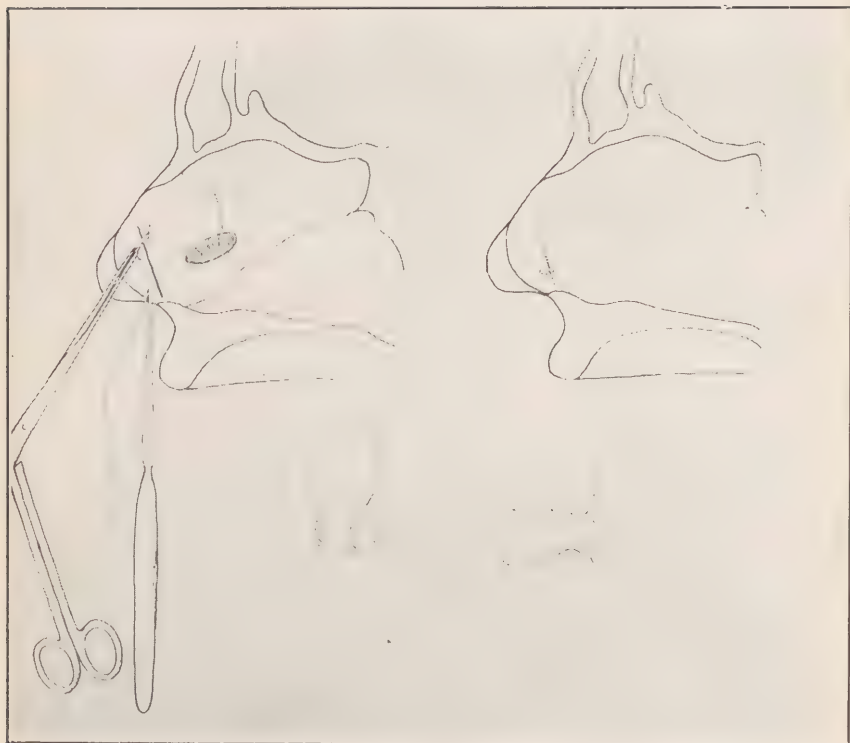


Fig. 25—Diagrammatic drawings of procedure in closing perforation, showing position of needle and angular forceps; also suture, together with knot used in tying silk worm gut.

CHAPTER VI

TYPICAL CASE HISTORIES AND THEIR SIGNIFICANCE

One of the lessons learned by the surgeon who deals with septal deviations is that, as in the case of other long-standing structural alterations, many of the symptoms are aggravated by nervous conditions, which have resulted from disturbance of function. In a large number of cases where there is some obstruction, but not enough closure of the nasal orifices to call for operation, reeducation of the patient in his breathing habits will prove a less costly and painful remedy. It has been the experience of the writer, who in the course of a city clinical practice has observed thousands of these deviations, that operation is to be recommended in not more than twenty to twenty-five percent of the cases. It should very seldom be advised in the case of children under fifteen or sixteen years. Care should also be taken to avoid operation with persons suffering from high blood pressure or with a hemorrhaginous tendency. In all cases, a careful blood test should be taken, and those ruled out in which specific disease is present until after they have been treated. Highly nervous temperaments do not promise good recoveries, except with continued after-treatment, much of which should consist of reeducation in breathing habits. Altogether, the operation is the work of a skilled specialist, as speed is almost a *sine qua non* of complete success.

The cases described in this chapter have been chosen with the purpose of illustrating ways in which human behavior and idiosyncrasy in its many forms complicate the mechanics of surgical practice. Examples are also given of the cases which violate the general rules of procedure, as in the case of children and young people. Cases of asthma which show a definite causation in structural defect, and the cure by resection of ear troubles arising from nasal obstruction, are illustrated.

It will be of interest to readers who have come in contact with individuals returned from the draft army to civilian life in an apparently normal state, but who have a history of what has mistakenly been called "shell-shock," that these persons often prove practically inoperable under local anesthesia for the correction of deviations. Several of these cases have come under the writer's direct observation. During the winter of 1921, a sturdily built young man, American, a veteran of the World War who had never been wounded but who had been treated for mild shock, was presented for operation. Without warning, at the moment when the initial incision was to be made, he collapsed. Neither restoratives nor encouragement had effect, so that when the heart action was found to be slightly involved, the case was abandoned. The more recent literature dealing with war neuroses has modified the former attitude toward these individuals whose self-control has been lessened by strain and shock. Hurst has said of these states: "(Given a sufficiently powerful suggestion, there are probably no individuals who would not develop (these) hysterical symptoms."¹

¹ Croonian Lectures on the Psychology of the Special Senses and their Functional Disorders. Delivered before the Royal College of Physicians, in June, 1920, by Arthur F. Hurst, M. A., M. D., Oxon., R. F. C. P. London, 1920.

It cannot be too frequently reiterated that the operation for resection of the septum should not be performed on too young children. But, now and then, there are cases in which this rule must be broken, because of the seriousness of the obstruction. Miss C., an American girl of fifteen years, brought to the office by her mother in 1915, was an exception. There was a history of a fall from a tree at the age of eight years, with a fracture of the nasal bones and septum which had resulted in an almost complete obstruction of the anterior nares. The mother told of the difficult breathing which had become associated with a chronic laryngitis, a tendency to a high-arched palate, and a marked lack of development of the nose. The patient complained of a whistling and ringing sound in the ears, the usual and irritating symptom of a chronic catarrh in the middle ear, also, at times, a purulent discharge. These conditions had combined with the disturbances of puberty to call for correction by removal of the lower part of the septum, and thus prevent the gradual involvement of the entire respiratory system.

The patient's nervous temperament made it necessary to perform this operation under general anesthetic, thus changing the position taken by surgeon and patient in the classic operation. After anesthetic, a large posterior plug was inserted in the pharynx, in order to prevent the blood from flowing in the throat. The usual incision was made. The incisor crest and the lower part of the deviated cartilage with part of the osseous septum were removed. It was found necessary to curette most of the cartilage removed, as it was very adherent. Not so much of the septum was removed, however, as would have been done in the case of an adult, but sufficient to give free ventilation.

This operation was not a complete resection, the purpose being to remove only so much of the growing cartilage of the child as would afford a good breathing space. In the interval since this operation, the nose has developed, the breathing has become normal, and the ear trouble has disappeared. But it is only in such cases, where development is flagrantly retarded and where the sense organs are in danger of permanent impairment, that operation on growing children is advised.

An extreme case, indicating an operation in boyhood, was that of R., sixteen years old, whose septum had been fractured in a forceps delivery. The septum was pressing on the turbinate, and the turbinate was interfering with the drainage from the ethmoids, the frontal sinus and the antrum on the right side. The malformation early became associated with a polypus degeneration of the turbinate. The frontal sinus condition, protruding eye, and swollen face, showed the necessity for correction. In the operation, performed under ether, most of the perpendicular plate was removed together with the right middle turbinate and polypus. The ethmoidal cells, full of pus, were cleaned out by the Faulkner operation. This case was so bad that a nearly complete removal of the cells by the internal nasal route, with free drainage as the aim, was all that could be done, with no attempt to correct the external injury. The boy has made a complete recovery.

Another case, marked by nervous complications which affect recovery was that of Mrs. D., a white woman of Irish extraction, forty-six years old, tall and thin, who showed on examination a marked tendency to hyperesthesia. Although the deviation from which she was suffering was plainly traumatic, with

the associated gutter formation described in Chapter III and illustrated in Figure 5-c, she insisted that she could not remember the time when she had not suffered from interference in breathing. The right middle turbinate was found, on examination, to be considerably enlarged, giving a partial cause for her complaint of fullness of the right nostril. Both nostrils were slightly atrophic, and a synechia was present on the right side, between the lower turbinate and the nasal septum. In spite of the nervous condition of the patient it was seen to be necessary to remove the middle turbinate along with the submucous resection. The removal of the turbinate makes the operation somewhat longer and more painful; but a discharge from under the turbinate, and the cloudiness of the ethmoids and antrum shown upon transillumination, indicated its necessity. In spite of the fact that some of the disturbances of which the patient complained were the result of the climacteric, it was believed that the suppurative disease of the accessory sinuses was responsible for at least part of the severe headaches from which she suffered. The operation would give drainage and thus relieve both the physical and nervous condition. Under local anesthesia the septum was straightened and the turbinate removed for drainage. A well-developed ethmoidal cell was found in the right middle turbinate. A discharge which continued for some time after the operation was finally cured. The patient complained for some time of breathing first through one nostril, then the other, but treatment and suggestion that she pay less attention to her breathing finally overcame this form of nervousness. This is a very usual history for disturbance of long standing and the various symptoms need give the patient and physician little concern. When the nose is given ven-

tilation, nature will take care of the rest, if there is no necrotic tissue remaining and the patient will give his nose a chance. In all such cases there is a tendency to too frequent lavage with salines. This should not be indulged except when there is purulent discharge, and then under careful direction. It is to be remembered that the freeing of the air passages from obstruction will of itself prove the most wholesome corrective.

The relief of asthma by resection is illustrated in the case of Mr. G., a German-American, age fifty, occupation, butcher. Mr. G. had sought relief in 1912 from increasing asthmatic symptoms. At the time his trouble was diagnosed as the result of polypus growths, which were removed. The asthma was relieved for a time by this operation, but it gradually returned in an aggravated form, accompanied by constant harsh and labored breathing. This return had made Mr. G. distrustful of surgeons, but after seven years his condition was so bad that he was forced to seek relief. He then consulted the writer. Examination showed that the heavy breathing was associated with a slight affection of the apexes of both lungs. Attention was also directed to a marked posterior deviation of the nasal septum involving both bone and cartilage. (See Fig. 5-c.) It was explained to Mr. G. that this deviation was in all probability the original cause of the difficulties from which he had been suffering; and that, although many adjacent structures had become so involved that he could not hope for immediate relief, still his only hope of ultimate recovery lay in the correction of the deviation by surgery, with a removal of the ethmoids which had become involved in the degenerative process. The memory of the previous experience had left the patient so

skeptical that, although he was strongly advised to submit to the operation at once, it was postponed until November, 1920, almost a year from the time of diagnosis, and until he was ill with an aggravated attack of asthma. In spite of his bad physical state, there were no unusual conditions. The polypus, middle turbinate and ethmoids were removed by the Faulkner method. Up to the present time (November, 1921) there has been no tendency to a return of the asthmatic condition. The patient, who had become emaciated and despondent, is gaining weight and is improving in spirits. There is little doubt that in this case the correction at the eleventh hour saved the patient from a serious involvement of the whole respiratory tract as well as from a state of morbid depression resulting from the failure of the first operation to correct the difficulty.

A similar case to that of Mr. G. was that of Adolph G., German-American, age forty, a steel engraver by trade. Adolph came to the office as a private patient, giving a history of an asthmatic condition covering a period of twenty years. One of the persistent symptoms was pain in the nostrils. Examination disclosed a high Z-deviation, very pronounced on the right side. The classic operation, described in Chapter IV, was performed on this patient in May, 1909. During the twelve years since, he has reported at the office at intervals for treatment for ordinary coryza, but states emphatically that there has never been a recurrence of the asthmatic difficulty of the twenty years previous.

These two cases, among others, indicate strongly that there may be structural difficulties at the root of many cases of asthma, as also in the case of hay fever and "rose colds." Case histories of these difficulties which sooner or later involve the nervous system

show a nasal phase, with sneezing attacks from minor causes developing into a conditioned reflex stage. Alterations in irritability reenforce certain normal impulses and cause them to overflow their customary channels. This condition may well be more marked in certain patients with inherited instability of the central nervous system. Prolonged after-care of such cases is desirable, with an effort at reeducation affecting the reflexes. Other cases indicate the correction of dietetic and sexual excesses to reenforce the structural correction. The writer knows definitely of cases in which failure in the patient to correct the reflexes associated with a long-continued structural difficulty have positively countered the complete correction of what is usually the main cause of the trouble, namely, the closing of the nasal passages by injury. It is for this reason that in so many cases it is impossible to say whether it was the injury to the septum, or the nervous condition following the injury, which started the long series of after-effects in breathing, sneezing, and coughing idiosyncrasies. One thing remains true, however, that the clearing of the air passages by operation, accompanied by correction of behavior, results in most cases in complete cures.

Among the cases of serious ear trouble corrected by the resection of the nasal septum, is that of Patrolman E. McE., Irish-American, forty-two years of age, of the New York City police force. This man, of stalwart build and otherwise of normal health, came to the office at intervals in 1908-9 with a history of successive and persistent colds which were beginning to affect his efficiency as an officer. These colds had affected his ears to such an extent that he suffered from severe headaches as a result of stoppage. The right ear was especially affected, as was the right side

of the nose, through which he could not breathe. The ear trouble, which was accompanied by purulent condition which at times threatened serious complications, was first attacked. Examination had revealed an almost complete obstruction of the right nasal cavity, resulting from traumatic deviation, but because of the patient's objection to operation, an attempt was made to remedy the ear condition by local treatment without an attack on the cause of the trouble in the obstructed nose. After five years of treatment, with constant recurrences of trouble with the right ear, a refusal to treat the local trouble brought Patrolman McE. to an operation. This operation, performed seven years ago, resulted in complete recovery. In his own words, taken from a letter written December 15, 1920, the time of the year when he would be most liable to recurrence, he says: "After I was operated on by you, I could breathe freely through both nostrils, and am enjoying good health to the present time. I have gained in weight, and have not been suffering from the succession of colds as heretofore mentioned. . . . My nose appears straight, and has not fallen in any. Although I have received several punches, it has not broken under the strain. . . . An X-ray examination indicates that the septum is straight."

The case histories here given have been among the number which are convincing as showing the necessity of a developing and flexible technic to meet the special conditions which are constantly confronting the surgeon. They show the nasal septum as a disturbing factor, and fully justify dealing with it by operative procedure, when other means fail.

CHAPTER VII

THE SADDLE-BACK NOSE

One of the most unfortunate results that can come from faulty technic in the operation for resection of the septum is the falling in of the septum, which results in the condition called, from its appearance, the saddle-back nose.

There are several causes which may combine to produce this unfortunate complication, some of which are important enough for discussion.

First: If the mucous membrane is separated at a point along the ridge so high as to cause a cleavage from the lateral cartilages and the triangular cartilage as well, there may result a falling in of the dividing wall. This will account for a very limited number of these cases, which are evidently preventable. It can be guarded against by cautious procedure at the point of articulation between the triangular cartilage and the perpendicular plate of the ethmoid. When this point in the operation is reached, the separation should be accomplished by the removal of the cartilage with a sharp cutting instrument so as to have no pulling or separation at that point.

Second: Hemorrhage between the flaps, during the period of convalescence, may cause a falling of the septum. These hemorrhages are generally low down along the floor of the septum, but the hemorrhage may be so profuse as to cause a separation of the lateral cartilages, and when this occurs it is generally in the

first few days after the operation. Bad results may be prevented by a close watch over the patient. To treat properly, make a perpendicular incision with a knife. Insert cutting forceps, such as those of the Jansen-Middleton type, parallel with the floor of the nose for about two-thirds of the length of the blade. Remove the membrane and clean out the clots and *débris*. As a rule there will be little further trouble. The perpendicular incision for drainage purposes is of little moment, because the cut surfaces will unite in a short time.

Third: A purulent secretion between the flaps as a result of abscess is another possible cause of a falling septum. This appears at a later date than hemorrhage. Generally the first symptom is a swelling on both sides of the remaining ridge nearer the junction of the cartilage and the perpendicular plate. If not corrected, pus will sometimes nearly fill the space between the flaps. We have already said that, in a number of operations, we find ourselves compelled to leave a part of the deviation high up along the ridge. When we examine one of these cases we find on the side where the cartilage has been left an apparent bulging. On the other side there will be no swelling under normal conditions. But in the case of abscess, when we examine the nose with a speculum, we will find an almost equal bulge in each nostril on both sides of the septal wall. Treatment consists of cocainizing the septum at the bulge and making a perpendicular incision through the swelling. If pus is present it can be reached with little difficulty. The first incision is for diagnostic purposes only. For drainage, proceed with Jansen-Middleton forceps as in the case of hemorrhage. If the nose is kept free from clots there will be few grave results in the case of either hemorrhage or ab-

scess. It is well, however, to watch these patients carefully for a number of days.

Fourth: An atrophy of the remaining cartilaginous tissue will sometimes cause the support of the wall to be absorbed. Just what causes this atrophy and absorption is sometimes difficult to tell. In some cases a syphilitic condition is found. Again, pressure on the septum, sometimes unexpected, at other times through wilfulness of the patient, will result in a cave-in. A young woman, on one occasion, came to the office on the fourth day after an operation. The nose was swollen and giving her considerable pain. In an irritated fashion, she placed her index finger on her nose and pressing it flat asked if the nose were going to stay in that position. When earnestly requested not to do so dangerous a thing and warned of the possible result, she repeated the procedure. On examination, it was found that she had pulled away the portion of the triangular cartilage which articulates with the perpendicular plate of the ethmoid. Today, this young woman has a marked deformity as a result of her behavior.

Although the causes enumerated above might indicate that this result of the operation on the septum occurs frequently enough to make the operation dangerous to good looks, as a matter of fact, the accident of the cave-in is rare. Constitutional difficulty is the only real reason for its ever occurring. Care in the operation, care and patience on the part of the patient, and watchfulness of the healing process on the part of the operator, will prevent these cases. Their frequency is exaggerated because the conspicuousness of the nose makes every such mishap visible to every passer-by. It need never cause a patient to hesitate to entrust himself to a careful operator.

CHAPTER VIII

CONCLUSION

A review of the pages of this book is, for its author, a retracing of the steps that brought him through the years to the place where he is ready to put in form for others the fruits of his experience. First came the study of the normal nose, its structure of bone and cartilage, its circulatory and nervous system, and its functioning, so important in the life of the individual. When we think of the results of malformation of the nose in its disturbance of two of the special senses, smelling and tasting, with its less direct, but none the less, serious disturbance of sight and hearing, and the resulting affection of the respiratory tract, we realize the far-reaching importance of careful study of these disturbing conditions. As the victims of septal deviation have come in steady procession through office and clinic through the years, gradually the general classification of these deviations, given in Chapter III, has taken form. Such a classification does not mean necessarily that any one case can be said to be a "normal" S- or Z-deviation. It rather means that as cases of this or that sort are superimposed in memory, they become a "composite picture" looking like one or the other type.

The type or picture once in mind, next comes the working out of an operation that will meet the conditions of such deviation as nearly as can be. Such an operation, always looked upon by the most skillful of

the pioneers in the field as a serious one, calls for a procedure which shall combine as little shock as possible for the patient with speed and safety. To accomplish this end, the method of anesthetization, posture, and perfecting of instruments, all have contributed. A careful study of earlier incisions, and the use of one or the other in early practice, finally led to the abandonment of all of them for the present line of incision so clearly indicated in the nose of the anesthetized subject. This incision, now used for ten years, has shown itself conclusively best by the number of successful operations.

But from the line of patients with septal deviations the surgeon is to choose operable cases with conservatism. It is not that many more might not have the obstruction removed and the deviation corrected. Other conditions are involved to make the operation successful. As Haldane notes in his study of breathing, that function is "the outward expression of one side of the coordinated activities which we lump together under the name of metabolism."¹ Subjects should be chosen who can go through the post-operative period to normality, given the correction of this one difficulty, but those with other constitutional difficulties can hardly hope for recovery even with correction. Again, with cases slight enough to profit by self-correction and reeducation without operation, it should be avoided. Modern surgery has learned the lesson of integration. The case histories given in Chapter VI illustrate this point.

Biologically speaking, the head is the most important part of the animal. For the human animal, the nose is of paramount importance. It makes for beauty

¹ Haldane, John Scott: *Organism and Environment as Illustrated by the Physiology of Breathing*. 1917, p. 86.

or lack of it. It makes for comfort or discomfort, as it aids or impedes his breathing. It makes for pleasure or a dullness of perception, as smell is acute or clouded. In short, it makes for the adaptation of the individual to his life conditions, his happiness or sorrow, success or failure. In the name of the patients through whom the writer has learned the lessons of this little book, he commends it to the surgeons who may in its pages learn something which will be of benefit to the procession of septal deviations still to come.

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